THE

AMERICAN REVIEW OF TUBERCULOSIS
ABSTRACTS OF TUBERCULOSIS

VOLUME XIX MAY, 1929 ABST. No. 5

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Rheumatism and Tuberculosis.—The tissues react toward the tubercle bacillus with lesions of endless variety in degree, kind, and time. Many so-called "rheumatic" affections, which do not yield to antirheumatic treatment, are really manifestations of chronic tuberculosis. These chronic inflammatory lesions are often the end-results both of acute lesions and of true histological tubercle. The lesions are the most chronic which occur in tuberculosis, and cause mainly mild and transient symptoms. These lesions are most common in the secondary stage of tuberculosis, when tubercle bacilli, in small numbers, are circulating in the blood, before tertiary disease occurs in the apex of the lung. Among other manifestations, tuberculosis may cause lesions suggesting rheumatism of joints with painful swellings, in some cases with erythema nodosum, also pains in the muscles and in one or more joints, in the chest without signs of pleurisy, in the neck and in the eyes or head, disturbance of the heart's rate and rhythm and even pains in the nerves (sciatic). An early diagnosis of these lesions can only be made by means of tuberculin.—*The Affinities between Rheumatism and Tuberculosis, W. C. Wilkinson, Brit. M. J., May 5, 1928, no. 3513, 749.*—(*W. I. W.*)

Prognosis in Tuberculosis.—Tables are given to show the enormous differences in the resisting power of individuals attacked by the tubercle bacillus. In 52 per cent of the cases the patients had been ill for more than six months before the tuberculosis medical officer was called in, and in 48 per cent for a shorter period. There were 1,266 patients who survived more than six months after they were first seen by one of the tuberculosis medical officers. Seven hundred and forty-three had tubercle bacilli in the sputum, and 523 had not. Three methods of treatment were available: (1) dispensary, where tuberculin was used in all cases; (2) sanatorium, where tuberculin was used in very few cases, and (3) domiciliary.

Among the patients who had tubercle bacilli in their sputum, and who did not receive either dispensary or sanatorium treatment, 2.4 per cent were at work after ten years, and 44 per cent of those who had negative sputum were at work after ten years without any special treatment.—*Prognosis in Pulmonary Tuberculosis, J. R. Gillespie, Brit. M. J., March 17, 1928, no. 3506, 436.*—*(W. I. W.)*

Roentgenography in Prognosis.—The object of this article is to present some general principles in the prognosis of a tuberculous condition as seen in the roentgenographic plate. The ability of pulmonary tissue to produce fibrosis or calcification about a tuberculous area is an important index of the fighting qualities of the body. Symptoms in any case depend in great measure upon the vascularity of the infected area, and the avascularization of such areas through fibrosis is a means of lessening toxic absorption. A large exudative area about a tuberculous focus means much vascularity and a high degree of allergy. Hypersensitiveness, manifesting itself by flare-ups following reinfection or stimulation by nonspecific means, can easily account for the exudation about a focus without the need of explaining it on the basis of secondary invaders. Chemical substances, and fatigue, physical and nervous, stimulate the tuberculous focal reaction. Dense fibrosis involving one or more large areas is often seen coëxisting with other areas of more active tuberculosis. Fibrosis resulting from nontuberculous pulmonary lesions, such as unresolved pneumonia and lung abscess, may present difficulty in differential diagnosis.—*Roentgenography in Prognosis of Pulmonary Tuberculosis, A. G. Schnack, Am. J. Roentgenol. & Rad. Ther., November, 1927, xviii, 453.*—*(W. I. W.)*

Prognostic Value of Laboratory Tests.—In the course of a pneumothorax the state of affairs and prognosis are rendered particularly difficult to determine. The less complicated laboratory tests were first studied in this connection at the Sanatorium Brugman at Alsemberg, Belgium, later the more complicated ones. *Tubercle Bacilli in Sputum:* This was investigated by homogenization if direct examination proved negative. It can be definitely affirmed that disappearance of bacilli is a favorable omen. *Elastic Fibres in Sputum:* The orcein technique is ordinarily used, by which these fibres stain brownish-violet; but this is too time-consuming. The following procedure was substituted: *1:* Homogenization and slight heating with a 4 per cent solution of soda. *2:* Centrifugation with addition of distilled water. *3:* Smearing and fixation of clot on slide. *4:* Light staining with Ziehl's carbol-fuchsine, cold. *5:* Washing with acidulated water (acetic) and examination under high power. A newer method employs a drop of China ink after liquefaction and homogenization; with this the fibres are white on a black field. Disappearance of elastic fibres is of good omen. *Albumin Reaction in Sputum:* Roger's technique is followed. As a rule the albumin reaction becomes negative as tubercle bacilli disappear. *Red-Cell Sedimentation:* The technique of Fahraeus-Westergren is employed, using a 3.8 per cent sodium-citrate solution, haemolysis tubes, and 300 mm. tubes of 2.5 mm. calibre, specially marked. The height of the red cells after one hour is the index of sedimentation. Normally 2 to 3 mm., in pathological states sedimentation may reach 10, 50, or 100 mm. or more. In every patient in the sanatorium tested the sedimentation reaction reflected accurately the clinical progress, and changed with changes in the latter. The changes which occurred accompanied the pulmonary rather than the constitutional condition, that is, reflected the activity of the disease, not the general state of the patient. Sedimentation is normal only in cured or arrested cases. If such a case undergoes reactivation the sedimentation index will increase. Whenever a positive subcutaneous tuberculin reaction occurred sedimentation was increased. *Leucocytic and Arneth Formulae:* There was found to be a general parallelism in sanatorium patients between the sedimentation reaction and deviation in the Arneth formula. The leucocytes were also studied with a view to the formulae described by Richard (formula of resistance, formula of defense, formula of deterioration). Tables are given showing the occurrence of these varieties of reaction and their value in determining whether pneumothorax treatment should be employed. *Laboratory Findings in Complications of Pneumothorax:* The sedimentation reaction is especially sensitive to such developments as serous pleurisies. The other reactions are also affected. *Conclusions:* The ensemble of laboratory tests is indispensable for prognosis in pneumothorax cases. The erythrocyte sedimentation and Arneth picture are of most significance, and together with the leucocytic formula reflect accurately the clinicopathological changes, including intercurrent pleurisies and exacerbations in the supposedly healthy lung.—*Le pronostic dans la tuberculose pulmonaire et spécialement dans*

le pneumothorax, secondé par les recherches de laboratoire, Malévé, Rev. Belge d. l. Tuberc., July–September, 1926, xvii, 175.—(A. P.)

Tuberculosis Mortality for World in 1925.—During the last forty years the tuberculosis mortality has been diminishing in almost all the Western European cities and those of the United States. More recently it has declined in Eastern and Central European cities. On the other hand, the cities of South America and India show an increase. The decline has usually been gradual, as in London, Paris, the Swiss cities, the Low Countries, and the Scandinavian countries. In Central and Eastern Europe it has been more abrupt, as, for instance, in Budapest, Vienna, Moscow, Leningrad. Among the causes cited for this decline are: *1:* Progressive amelioration of living. *2:* Elimination of masses of less resistant persons by famine and other debilitating factors. This would appear to be so in the case of Moscow, where the mortality reached its height in 1919, and abruptly fell, until in 1925 it was only half of that existing from 1901–1910. The influenza epidemic appears to have played a similar rôle in Western Europe and the United States. *3:* Elimination of opportunity for infection. This factor can only have an effect over a long period. As far back as our statistics go the urban tuberculosis mortality has exceeded the rural, but their relative levels have not been constant. At present the urban tuberculosis mortality is diminishing in all Western European countries. In the most urbanized and industrialized countries (England, Scotland, Germany, New England) the rural mortality is also diminishing. In other countries, such as France, Ireland and Switzerland, it is stationary, and is increasing in Japan, the Balkans, Sweden, Norway and certain Spanish provinces. Normally, tuberculosis mortality falls first in the cities, then in the country; and in the urbanized and industrialized states sooner than in the agricultural. This despite the fact that the urban figures remain constantly above the rural. Although tuberculosis mortality is decreasing in most European countries, the United States, Eastern Canada, and Australia and New Zealand, as well as the Japanese cities, it is stationary or increasing in Central and South America, India, the Malay states, China, and equatorial Africa. In French North Africa and the Union of South Africa it diminishes among the whites, is stationary among those of mixed blood, and increases among the natives.—*La mortalité mondiale par la tuberculose en 1925, Renseignements statistiques publiés par la Société des Nations, Rev. Belge d. l. Tuberc., September–October, 1927, xviii, 251.—(A. P.)*

Mortality According to Sex.—Statistical analysis of "mortality and population data by sex, age, and census year for the United States Registration States of 1900 and the District of Columbia, for the period 1870 to 1920," reveals that there are significant sex differences in the mortality rate from tuberculosis for all ages except the group of seventy-five years and over. These differences are independent of differences "shown by population and total mortality." Female deaths exceed male deaths during the ages of five to twenty-four and reach the highest level at ten to fourteen years, at which time it is as 3 to 1. After the year 1890 male deaths exceeded female deaths, and the excess is maximum at ages 45 to 54. The prevalence of tuberculosis deaths declines for both sexes in each group during the fifty-year period of observation, the rate of decline being about the same for the two sexes under age 35: in older ages the decline is greater among females. The differences in the death-rates from tuberculosis in the sexes in ages below age 25 are biological and seem to be associated with adolescence and puberty. In the ages above 25 environmental factors,—wear and tear greater on men, etc.,—probably determine the higher death-rate among males of these ages. The decline in every age-group in the later periods (decades) of observation appears to depend upon the general improvement in hygiene, social and economic status, etc.—*Sex Differences in Pulmonary Tuberculosis Deaths, P. Putnam, Am. J. Hyg., November, 1927, vii, 663.—(H. S. W.)*

Tuberculosis Mortality of Sailors.—Knobel calculated the average annual death-rates among water-transport workers in London for the years 1921 and 1922 as follows: Petty officers, seamen, and deck-hands, 3.5 per 1000; firemen, greasers and trimmers, 7.0 per 1000; pursers, stewards and domestic staff, 4.4 per 1000. The rate for the total occupied males in London for the same period was 1.8 per 1000. Confined quarters and poor accommodation provided for the crew in many ships are no doubt partly responsible for the prevalence of tuberculosis. The system of four hourly watches is probably not without danger to health. Excesses ashore doubtless play a part. Patients admitted to a sanatorium almost direct from the ship generally have a severe form of tuberculous disease. Early and doubtful cases are hardly ever seen,

whereas the acute, progressive lesion is only too common.—*Tuberculosis and the Sailor, J. F. Wood, Brit. J. Tuberc., April, 1928, xxii, 57.*—(*B. T. McM.*)

Human Tuberculosis in Belgian Congo.—Calmette speaks of the rôle played by slavery in tuberculosis of African natives. The slave traffic invaded the Belgian Congo from three sides. On the North and East the Arab traders penetrated to Stanleyville. On the West the Atlantic Coast region was for centuries the seat of the slave traffic. Before the creation of the Congo Free State Europeans from the West had not passed Matadi, and the Arab penetration was localized to a few regions. The Belgian occupation opened up paths of communication. Before this tuberculosis existed in only a few communities, such as the Low Congo and the region of Kisanter, near the Atlantic Coast, and no name was generally known for it. The European carrier of tubercle bacilli has infected his native servants and helpers, soldiers, and workers, and they, returning to their original habitations, have spread the infection. Little by little tuberculous foci have formed around European centres of population and, although still rare in the interior, the disease is spreading. Before its extension the Government, alarmed, ordered measures designed to remedy the situation. When Rodhain first arrived on the Congo, in 1903, he was struck by the absence of tuberculosis among the natives with whom his medical work was concerned. However, he happened to arrive at Ubangi early in 1904 to take the place of a tuberculous colleague who had spread tubercle bacilli all about him. The latter's two servants succumbed to the disease three and four years later. From that time until April, 1906, he did not see another case among the natives. But at the hospital for the blacks at Leopoldville, in 1907, and during the next two years, he saw a considerable number and variety of cases, which he mentioned in his 1909 report. In 1913 Mouchet called attention to the finding of tuberculous foci in 37 per cent of 79 autopsies. He then carried out skin tests, and concluded that Leopoldville was quite an intense centre of the disease, but localized and of relatively recent origin. He noted that its course was very rarely slowly progressive as in the European. The tuberculosis curve in the natives was found to follow in a general way that in the European population but was less widespread. In 1917 strict instructions were given to medical examiners in Europe in order to detect the tuberculous, and both curves fell. After the War there was an increase in both Europeans and natives, due to post-war laxity. The effects on the blacks seem to depend on the quickness of detection of the disease in African whites and of their repatriation. Every native case has been rapidly fatal. Rodhain has observed the formation of native centres by soldiers at Yakoma and Bowama, the latter situated in the midst of the great forest of Aruwimi, and he found a tuberculous subject at the Catholic mission of the Amads. Seven patients were discovered in the Velé, and S'Heeren, pursuing the subject, found 11 cases in the region of Bondo-Lebo. The natives of this region have long been in contact with the Arabs of the Darfour, who call the disease "Dingo." Statistical reports from the different regions of the Congo show a definite relation between the importance of the European population and the number of native cases of tuberculosis. But, although the tubercle bacillus has become implanted everywhere that the European goes, it has not become uniformly disseminated in the interior. In 1912–1913 Mouchet carried out skin tests at Leopoldville and found about 7 per cent of positive reactors. Rodhain repeated these at Leopoldville, Kinshasa, Lokandu and Boma; and has tabulated these, together with the results of others made by colleagues in other localities, chiefly military centres. In these latter 807 soldiers and recruits were tested, of whom 9.5 per cent in all yielded positive results, 5.3 per cent being doubtful. The highest proportion of positives, 22 per cent, was found at Bangalas, Ubangi, Haut-Velé, and Bas-Velé, and Lomami yielded about 15 per cent. Five hundred natives from the interior yielded 4 per cent positives. The total positives for adult males were 7.5 per cent. At Irebu 391 women and children were tested, with only 1.8 per cent positive, lower than the proportion among natives of the interior. At Leopoldville 54 boys showed 5.4 per cent of positive reactions, and 62 girls only 1.8 per cent. These figures show the rarity of tuberculosis among natives of the Belgian Congo as compared with the figures for European countries. However, at Leopoldville the proportion of positive reactions has quadrupled since Mouchet's observations in 1912–1913. In the school colony at Boma a very high proportion of reactors was found,—54 per cent among children over 15, and 27 per cent among those under 15. Shortly after the tests an old instructor of carpentry died of pulmonary tuberculosis with cavity. He had been sick three years. Of 129 necropsies done at Boma by Fornara on tuberculous subjects there was noted pulmonary involvement in 101, intestinal in 49, and generalized miliary in 48, with scattering lesions in other organs.

Generalized miliary involvement was therefore found in one-third of all cases coming to necropsy. *Prophylactic Measures:* The Government in December, 1920, authorized the Governor-General to institute certain measures, as follows: *1:* Obligatory declaration of tuberculosis. *2:* Prevention of entry of non-native persons with lesions of open tuberculosis. *3:* Compulsory departure of non-native tuberculous persons with open lesions. *4:* Temporary isolation of such persons in hospitals unless certain precautions are observed. The same precautions are to be observed with natives found to have the disease, and the physicians have full authority to carry out all necessary examinations. In 1922 only 20 tuberculous whites were present in a population of 9,631. Isolation of native patients is difficult. The patients leave as soon as they are improved. However, two sanatoria are being established at Banana and Leopoldville. Sclerosing forms of the disease have been observed at Leopoldville and Boma. These patients are the most apt to spread the disease. It seems likely that these forms will become more common as the population adapts itself to European civilization.—*Rapport sur la tuberculose humaine au Congo belge, J. Rodhain, Rev. Belge d. l. Tuberc., November–December, 1927, xviii, 255.—(A. P.).*

Spread of Tuberculosis in Japan.—Tuberculosis is an infectious disease which may be acute or lethal in those without immunity and chronic in those with moderate immunity, while in persons with high immunity it fails to manifest evidence of pathological deviation from normal. In the cities and densely populated areas of Japan three distinct types of tuberculosis are encountered. The acute form often appears in persons in healthy families that have recently come from rural districts. Instances are quoted in which four or five or more members of a previously healthy family have died within a comparatively short time. People may be exposed either to large numbers of fresh virulent tubercle bacilli in the spray or droplets from a sick, coughing patient, or to old, dry, weakened or dead bacilli that are wafted about in the air. In general, those exposed to bacilli by the former mode of infection are more likely to become ill than those exposed to weakened and fewer bacilli. It is characteristic of virginal tuberculosis that (1) it proceeds like acute infectious diseases; (2) it has few or no symptoms of pleurisy and no cutaneous or other allergic forms of the disease; and (3) it rarely shows haemoptysis or surgical forms of the disease. The immunity to the disease depends upon the ubiquity of the tubercle bacillus, and the "saturated soil" of those persons who have the disease and who keep up the spread of the bacilli. Thus the germ tends to cause a healing of the disease which it has the capacity to create. Only in this way can we understand the decline in mortality when people are becoming increasingly more herded together as the result of industry, etc. Tuberculosis is an infectious disease in which a specific immunizing agent should help us greatly.—*Epidemiologie der Tuberkulose in bisher Tuberkulosefreien Gebieten von Japan, R. Arima and I. Ishihara, Deutsche med. Wchnschr., January 27, 1928, liv, 127—(H. S. W.).*

Antituberculosis Campaign.—The campaign against tuberculosis should encourage investigation and study of the disease. We know nothing of why some of the children exposed to the disease fall ill while others do not (constitutional problem). We do not know why exposure to tuberculosis is a matter of protection to some children and of danger to others (immunological problem). We know that close association with a tuberculosis patient may lead to massive infection; that the tuberculosis of adults may be due to a reinfection and is not necessarily endogenous; that the first infection in the child and the new infection in the adult can be detected only by the roentgenograph. It is obvious that families which are "saturated" should be cleaned up rather than that all the attention be given to the sick individuals. The campaign should stand for general preventive hygiene and for general as well as individual attention to ill people; for generalization of roentgenological diagnosis at state expense; for such curative efforts as hospitalization, specific therapy, pneumothorax, etc., and for isolation of the very sick. It should keep healthy persons away from tuberculosis institutions. Organization of prevention can be met only by the coöperation of physicians and societies with social agencies and clinical researches controlled by physicians; by placing hospitals near the large cities, and establishing sanatoria for more favorable cases; by having no waiting list; by having in such institutions physicians who know general medicine. All depends upon cooperation.—*Umbau der Tuberkulose bekampfung, A. Fraenkel, Deutsche med. Wchnschr., November 11, 1927, liii, 1949.—(H. S. W.).*

Antituberculosis Experiment in North Sweden.—The experiment was begun in 1908 by the Swedish National Association, and was carried on in a section of the far north of Sweden where tuberculosis was most

prevalent. In this area the winter is long and dark, the spring bleak and cold, the autumn windy and rainy, and the people extremely poor, and ill-fed and housed. Whole families sleep in a single room, often the kitchen, and in "cupboard beds" with the lid tightly closed. At the beginning of the work at the institute it was found that, of the people in the district, about 2,000 in all, of which 90 per cent were examined, 12 per cent were suffering from active pulmonary tuberculosis. The work done by the institute consisted of medical attendance and nursing, public education, and other prophylactic measures. Efforts were concentrated on the protection of children. Members of families with active disease were advised to go to the institute for free sanatorium treatment. If this offer was refused an attempt was made to persuade the parents to send their children to the institute, where they were cared for free of charge. At the end of eighteen years of such work the population was again examined. Striking results were noted. The incidence of active pulmonary tuberculosis was 8 per cent, as compared with 12 per cent of the total population in the beginning of the institute's work, while in the surrounding communities the morbidity and mortality of pulmonary tuberculosis increased during the same period. The reasons for the present high frequency of tuberculosis in the district studied are probably several. First, the population has not yet acquired what is called a "biological defense" against tuberculosis, for it is pointed out that it is only within the last one hundred years that pulmonary tuberculosis has existed in northern Sweden. No doubt too the people are lacking in what is called "cultural defense" against the disease. It was also noted that the most marked decrease in morbidity and mortality of tuberculosis is found in parts of Sweden which a century before had shown the highest mortality, and the least decrease and highest mortality is found in those countries which a century ago were almost exempt from the disease.—*The "Hälsan" Institute: An Anti-tuberculosis Experiment, on the Lines of Social Hygiene, in the Far North of Sweden, G. Neander, Brit. J. Tuberc., July, 1928, xxii, 119.*—(*H. McL. R.*).

Antituberculosis Campaign in France.—*I: Conditions before the War:* In February, 1916, the military statistics showed over 100,000 men returned to their homes with a diagnosis of tuberculosis since the beginning of the war. This sounded the alarm, and under the urging of Léon Bourgeois France began to organize against tuberculosis. As recently as 1913 there was practically no organized effort to combat tuberculosis. Antituberculosis measures, especially means of diagnosis, scarcely existed. There were about 40 dispensaries scattered in 15 "departments," mostly merely centres of consultation and distribution of medicine; there were scarcely a dozen sanatoria, with about 1200 beds for adult pulmonary tuberculous. Two great efforts were made: *1:* The *Comité National d'Assistance* for tuberculous soldiers organized departmental committees and dispensaries for the benefit of returned soldiers and their families. *2:* Under the auspices of the Ministries of War and the Interior 40 sanitary stations, with 3000 beds for the treatment of tuberculous soldiers, were established. Jules Brisac and Léon Bernard were prominent in directing and endorsing both these works. *II: Popular Education and Legislation: 1:* Prior to the war there were few efforts at popular education, although the *Direction de l'Assistance et de l'Hygiène Publique* and the *Comité National d'Assistance* for tuberculous soldiers attempted some prophylactic education from the time of mobilization. Before the war, however, there was no legislation concerning tuberculosis. Only in April, 1916, under the so called Léon Bourgeois law, did antituberculosis organization begin to have a legal status. *2:* In 1917 the Rockefeller Foundation contributed resources in the form of a special mission made up of experts in social medicine. With the assistance of the French government and the *Comité National* they made a thorough investigation and established a program of action centering in a powerful campaign of popular education, combined with the necessary medical administrative measures, establishment of statistics, organization of dispensaries, etc. These efforts continued for five years. On its arrival the Rockefeller Mission found 22 functioning dispensaries, and on its departure there were 421. *3:* In September, 1919, was passed the *Loi Honnorat* regarding establishment, supervision and Government aid to sanatoria, and in 1923 these privileges were extended to preventoria. The *Comité National* has also organized an antituberculosis seal sale to augment its resources. The idea seemed excellently adapted to democratic coöperation, and had succeeded well in Denmark, where it was begun in 1904. The sale was first launched in the department of Meurthe-et-Moselle and was soon extended to other departments with very satisfactory results. The popular campaign, as carried on by the *Comité National*, utilizes the public press, pamphlets, cinematograph, radio, and theatre. Posters are used, and also the space in railroad trains and commercial vessels. In 1926 a special

Committee on Propaganda under the National Office of Social Hygiene was established to carry on this educational work. *III:* Function of the *Comité National de Défense contre la Tuberculose:* Since 1919 this body has been the centre of all antituberculosis activities. It is administered by directors who represent the departmental committees and is practically directed by a Bureau of six and a Director-General, Doctor Arnaud. It has three principal services: (1) technical, (2) propaganda, and (3) statistics. There is also a school of visiting nurses. The present antituberculosis armament comprises 590 dispensaries in 85 departments, with 1000 visiting nurses in 14 schools; 125 preventoria with 10,000 beds; 59 marine sanatoria with 12,500 beds; 85 sanatoria for pulmonary tuberculosis, with 8,337 beds; 14 hospital sanatoria, with 3000 beds; and 114 general-hospital services with tuberculosis pavilions, with 6,400 beds. Thus, 23,000 beds are available for collective placement in preventoria and 18,000 for the placement of pulmonary tuberculosis. To this must be added the work with Calmette's *BCG*, carried on by the Pasteur Institute. The mortality from tuberculosis among the vaccinated children in the first year of life has been 1 per cent, as against 82 per cent for those exposed to tuberculosis and not separated or vaccinated. It is estimated that in twenty years the tuberculosis mortality has been reduced 41 per cent, and for Lyons, where dispensaries are particularly active, 50 per cent.—*L'organisation de la lutte antituberculeuse en France, L. Viborel, Rev. Belge d. l. Tuberc., January-February, 1928, xix, 31.*—(*A. P.*).

Infectiousness of Contaminated Clothes.—Needlework and similar cloth articles were contaminated by the coughing of open cases of tuberculosis that showed tubercle bacilli in their mouth-spray and suffered with marked catarrhal conditions. The material thus contaminated was rinsed thoroughly in physiological salt solution, as well as ground up in it, and the resulting centrifugated sediment was injected into guinea pigs. None of the guinea pigs thus inoculated became infected. If, however, the same experiment was tried with handkerchiefs which had been expectorated into, all the animals became infected. From these experiments it is concluded that clothes, laundry materials, etc., infected with cough droplets containing tubercle bacilli, offer no hazards to those who wash them, while materials contaminated with tuberculous sputum containing bacilli are distinctly dangerous, and should therefore be disinfected.—*Beitrag zur Kenntnis der Verbreitung der Tuberkulose durch tuberculoseinfizierte Gegenstände, Braeuning and Wankel, Ztschr. f. Tuberk., 1928, l, 21.*—(*H. J. C.*).

Heredity of Tuberculosis.—This subject is one of the most attractive and at the same time most complex in medicine and biology. Recent bacteriological discoveries have again brought it to the fore. Experimental as well as social conceptions appear in a new light. The intensive antituberculosis campaign carried on after the war appears to show that a child, separated at birth from a contaminated environment, does not contract tuberculosis. But recent discoveries of a "filterable virus" add a new side to the picture. The problem resolves itself fundamentally into these questions: *1:* Can the tuberculous virus be transmitted directly, at the time of fecundation, from one generation to another? *2:* Is the paternal organism susceptible of undergoing, under the influence of this virus, pathological modifications transmitted either directly to the descendants, or in the form of certain imperceptible somatic lesions, which create a lowered resistance and favor receptivity of the virus by the body, that is, a so called "predisposition to tuberculosis?" Are the issue of tuberculous parents endowed with either heightened sensitiveness or lowered resistance to the tuberculous virus? *Direct Transmission:* This may occur either through an ovule contaminated by the mother before fecundation, or by the father at a later period. The question of seminal transmission is disputed. There remains another possibility, transplacental infection from the mother. The placenta may be likened to a filter. It is known, however, that the following infectious agents may pass through: syphilis, cholera, malaria, staphylococci, variola. Gaertner has tuberculized 10 female rabbits in gestation with a suspension of tubercle bacilli introduced intravenously, and found only 10 of a litter of 50 affected with tuberculosis. Landouzy and Laederich, in 86 experiments on embryos of various animals, succeeded in demonstrating tuberculosis only once. On the other hand, in cows, transplacental infection has often been observed. Contamination after birth, by simple contact, is not always easy to rule out. Transmission of the virus at the moment of fecundation must be regarded as highly exceptional; however, in cases of pelvic or tubal tuberculosis infection of the ovum in its passage has been proved. Proof of transplacental contagion is as follows: (1) microscopic and bacteriological examination of the placenta; (2) positive results on animal inoculation of placental tissue; (3) culture and inoculation of blood from the

umbilical vessels; and (4) exceptionally, bacteriological examination of the embryo and animal inoculation of embryonal tissue. In none of these methods is account taken of atypical forms of the microörganism. Ferran was one of the first to oppose the classical conception of the morphology of the tubercle bacillus, believing it to exist in five forms, and to be related to B. Coli. The work of Nocard and Roux (1888) and of Metchnikoff is cited, and the extremely interesting studies of Arloing and Courmont on homogenized bacilli. The determination of a filterable form seems to have been established by Vaudremer in 1923, his observations being confirmed by Bezançon and Handuroy. Valtis has also demonstrated filterable elements in sputum and pus, while Durand has produced in a male guinea pig a tuberculous orchitis by inoculating filtered pus intraperitoneally. Such a virulent filtrate produces varied manifestations, sometimes atypical. Arloing, and Dufourt and Malartre, find that the lesions have a predilection for the lymph nodes and that the filtrate keeps its pathogenic power even after a week's exposure to icebox temperature. Sometimes a subcutaneous injection of the filtrate sets up a specific arthritis of the Poncet type. Intravenous inoculation usually kills in eight to nine days, the heart's blood containing typical tubercle bacilli. In 1925 Calmette and coworkers confirmed the passage through the guinea pig placenta of filtered bovine-bacillus cultures. Can not one suppose, then, that the foetus may be carrier of a filterable form of tubercle bacillus, received from its mother in the course of uterine life, and that such virus may long remain inactive? The negative results of preceding experiments enjoin caution. *Transmission of Lesions or Modifications Resulting from Tuberculosis:* The question of transmission of acquired characteristics appeared to have been settled in the negative by Weissmann, but his experiments dealt almost entirely with traumatisms. Intoxications are in another category. The effects of alcohol on the germ-plasm appear undeniable, and the tuberculous virus might act similarly, even to the point of modifying external characteristics. Arloing and Dufourt, as well as Landouzy, call attention to a certain hypotrophy and atrophy, or "heredo-dystrophy," in children born of tuberculous mothers. Malformations or lesions of the circulatory apparatus, vascular atrophies, and nervous and skeletal disorders, are among the anomalies observed. These subjects come into the world with certain abnormal deviations which affect unfavorably their development and physique. Secretory disturbances, aplasia or hypertrophy of the lymphatic system, are included in this substratum or "terrain." Two possibilities regarding tuberculous heredity are to be considered: *1:* The descendants of a tuberculous subject conceived at the height of the disease may have conferred on them, not increased resistance, which seems unlikely, but a sensitiveness to the bacillus, creating a favorable terrain for its action. *2:* The descendants of a subject doing well and apparently healthy despite his tuberculosis may inherit a paternal "allergy" which increases their resistance. It is probable that such characteristics would be inherited as "recessives" according to Mendel's law, and might therefore appear in generations beyond the first, comparable to the appearance of traits of psychic degeneration or disease in the third generation. Stiller's "asthenic type" comes to mind as an example of inheritance of terrain. To eliminate the presence of infection as a factor is notoriously difficult. Children would have to be isolated immediately after birth and examined carefully at intervals, especially at puberty. A series of controls from parents free from tuberculosis would also have to be examined. That there is a certain suspicious mortality, even in isolated infants, is undeniable and here a filterable virus must be considered as a possibility. *Summary: 1:* Bacteriological researches pursued by the French school have recently established that, besides the typical form, the acidophile Koch bacillus, there are other morphological possibilities, especially a filterable virus. This may pass through the placenta and infect the foetus. *2:* Signs of parental degeneration due to the prolonged effect of toxic products may be transmitted in a more or less attenuated form to their descendants. Either increased resistance or increased sensitiveness may be inherited. *3:* Two related factors must be considered: (a) direct transmission of the virus from parent to child, and (b) the presence of a certain complimentary sensitiveness in the foetus. The humoral attributes of the foetus are to be considered as important in determining the end result. Further investigation is necessary and no precautions of isolation and detection of the disease should meanwhile be omitted.—*L'hérédité tuberculeuse, S. Sterling-Okuniewski, Rev. d. l. Tuberc., December, 1927, viii, 839.*—(*A. P.*)

Constitutional Factors in Immunity to Tuberculosis.—The establishment of disease is the result of two factors, namely the aggressive forces of the bacillus and the defense mechanism of the tissue. It must be emphasized that the latter is by no means of

constant magnitude. The well-known variation in the frequency of certain diseases in various age-groups is a manifestation of the variation in the defensive powers. Such considerations are of particular interest in the evaluation of a protective procedure such as Calmette's vaccination. In analyzing the resistance of the pulmonary tissue against the invading bacilli the following factors must be considered: The vitality of any tissue varies with the degree of its physiological function. In the case of the lung the vital capacity offers a measurement of physiological function. It is well known that in pulmonary tuberculosis the vital capacity is decreased, this decrease not being parallel with the amount of tissue destruction. It is, therefore, probable that the decrease is not the consequence, but one of the causative factors in the development of the disease. A low vital capacity is either constitutional or caused by an insufficient demand on the thorax. The study of these problems is important in the evaluation of the medical significance of physical training. Methodical training can undoubtedly increase the vital capacity. Resistance against tuberculosis is not determined by the actual size, but only by the respiratory function of the lung. It should be studied how various types of training influence the respiratory function and what may be the incidence of respiratory disease in various occupations with and without physical training. In such a way it should be possible to establish the desirable amount of physical training and to decide whether rest or exercise is a beneficial factor in healing pulmonary tuberculosis.—*Zur Debatte über das Calmettesche Verfahren der Tuberkuloseverhütung, L. Hofbauer, Wien. klin. Wchnschr., October 11, 1928, xli, 1438.—(M. P.)*

Effects of Dust upon Coal Trimmers.—When inhaled, many dusts will predispose to bronchitis and pneumonia. Free silica is the only one which definitely predisposes to tuberculosis. In direct contrast to this, coal dust is thought by many to be beneficial rather than detrimental to health. Numerous theories have been elaborated to explain the fact that the incidence of tuberculosis is low among coal miners. Data show that coal trimmers (who fill ship's bunkers with coal) have a mortality rate rather lower than the standard for phthisis, but definitely higher than the standard for bronchitis and still higher for pneumonia. But the numbers are comparatively small. Such factors as exposure to high temperature before furnaces and returning home from work in clothes damp with sweat may play a part in the high mortality from pneumonia and bronchitis in this group of workers. It is interesting, however, that, of 51 cases of cancer among coal trimmers, 22 per cent were of the skin as compared with 3.3 per cent of cancer among males in England and Wales in 1925. Of 11 coal trimmers that were suspected of having pulmonary tuberculosis, the diagnosis was confirmed in one case by a positive sputum. In the others the X-ray showed a condition that very strikingly resembled that induced by the inhalation of silica. Yet in persons exposed to silica there is an excessive mortality from phthisis while in persons exposed to coal dust the mortality from this disease is below that for the average male population. "The rarity of pulmonary tuberculosis among a group with lungs giving such radiographs is notable, and calls for care in interpreting radiographs." It seems unwise, from these observations, to assume that the "snowstorm" radiograph is absolutely diagnostic of silicotic fibrosis.—*Effects of Dust upon Coal Trimmers, E. L. Collis and J. C. Gilchrist, J. Industr. Hyg., April, 1928, x, 101.—(H. S. W.)*

Pregnancy and Pulmonary Tuberculosis.—The indications for abortion in tuberculous women depend primarily on whether pregnancy is unfavorably influencing the pulmonary tuberculosis. Most authors are agreed that this combination is undesirable, but there is no agreement on how frequently pregnancy demonstrably activates pulmonary tuberculosis. In considering this question it is necessary to take into account, not only the physiological action of pregnancy and parturition, but also the added social burden after delivery. The author is inclined to believe that the unfavorable influence of gestation upon pulmonary tuberculosis has been greatly exaggerated. Various explanations have been suggested for such an alleged unfavorable action, such as a decrease of lipolytic ferments in the blood, increased cholesterol content, demineralization, endocrine disturbances, decrease of tuberculin allergy, pushing up of the diaphragm, increased metabolic requirements, purely mechanical disturbances during delivery, etc. All these attempts at explanation are highly hypothetical. Moreover, statistical reports are not in agreement. The frequency of definite progression of pulmonary tuberculosis, caused by an intervening pregnancy, has been reported as anywhere between 7 and 100 per cent, and the mortality from tuberculosis complicated by pregnancy as from 4 to 100 per cent. Obviously, the statistical material, as presented so far, does not allow any definite deductions. From a therapeutic standpoint it would seem reasonable to

attempt, first of all to treat any complication, which exists or may arise during pregnancy, before terminating the pregnancy. This leads to the question of the prognosis of pulmonary tuberculosis, properly treated during pregnancy. Abortion should be considered only in active processes. There is no agreement on whether abortion definitely improves the prognosis of the tuberculosis. Some authors report very favorable results, while others claim that the end-results are not materially changed by abortion. The author believes that in a large percentage of cases conservative treatment is as successful as more radical measures. He has seen particularly good results from X-ray therapy. Children of tuberculous mothers are probably not handicapped if they can be protected from exogenous infection. The question of sterilization is fraught with much the same uncertainties as the problems discussed above. *Conclusions:* Every tuberculous woman who becomes pregnant should first be kept under strict clinical observation and should be put at complete rest. If the process is or becomes inactive the pregnancy should not be interrupted and the patient should, if possible, remain in a sanatorium. If, after sufficient observation, the process is still progressing and the pregnancy is older than four months, the same regimen should be instituted. If, however, the pregnancy has existed for only a few weeks in a similar case, abortion may be considered, and will, in the present stage of our knowledge, much depend on the personal opinion of the physician in charge of the patient.—*Lungentuberkulose und Schwangerschaft mit besonderer Berücksichtigung der Frage Schwangerschaftsunterbrechung und Sterilisierung, F. Schultze-Rhonhof, Klin. Wchnschr., October 14, 1928, xlii, 1989.—(M. P.)*

Preventorium Child.—It is well known that a "contact case," a child who has lived in more or less intimate association with a tuberculous individual, has become infected. The positive tuberculin test constitutes the indisputable evidence. The infected child often has symptoms of impending danger,—symptoms usually transient and attributed to some other condition. Ten or fifteen years later he may appear with active pulmonary tuberculosis. What has taken place in the interim? As an attempt to answer this question, the author studied 300 records of children at the Hofheimer Preventorium of the National Jewish Hospital of Denver. The children were from 2½ to 16 years of age, the average being 9.4 years, and were cared for between October, 1920, and February, 1928.

Seventy per cent of the children were underweight. Forty-five per cent had definite cervical or submaxillary lymph adenitis. In 30 per cent fever was a prominent symptom. In symptomatology or physical signs, there was no appreciable difference between tonsillectomized and nontonsillectomized children. The greatest incidence of clinical disease and positive physical signs was noted in those with a history of definite exposure. Physical signs were often negative when the history and symptoms pointed to active disease. Fever and fatigue were noted in about 50 per cent of known contact cases. X-ray examinations showed that of the total group 72, or 24 per cent, were normal; 228, or 86 per cent, showed enlarged hila; 195, or 65 per cent, manifested calcification in the hilar regions; 66, or 22 per cent, showed tracheobronchial lymph-node enlargement; 35, or 11.6 per cent, showed primary foci; and 34, or 11.3 per cent, frank pulmonary tuberculosis. The author believes that hilar calcification would have been found more frequently if films had been taken in the oblique position. Treatment was carefully individualized with regard to rest and exercise. The gradation method of heliotherapy was used, except in patients who had 101° temperature or more. Compulsory hours of sleep were from 1 to 3 P.M., plus a thirty-minute rest period before each meal. Outdoor play hours were from 3 to 5 P.M. The retiring hour was 8 P.M. Under treatment symptomatic improvement invariably occurred. Unremitting supervision was necessary, for in many patients there was a recurrence of symptoms with increased physical activity. There was no notable recession in the cervical or tracheobronchial lymph nodes after prolonged heliotherapy. Preventoria for the observation of children who have been exposed to tuberculosis, and for the treatment of juvenile tuberculosis, are needed as urgently as sanatoria for the treatment of adults with tuberculosis.—*The Preventorium Child, I. D. Bronfin, Am. J. Dis. Child., November, 1928, xxxvi, 931.—(P. J. W.)*

Childhood Tuberculosis.—The picture of childhood tuberculosis is changing. A couple of decades ago and more, osseoarticular, meningeal and peritoneal tuberculosis were quite common in hospitals and clinics. Suppurating lymph nodes, bones and joints were the order of the day, and orthopaedic and general surgeons were kept busy in the children's wards attending to surgical tuberculosis. To-day matted cervical lymph-node masses are rare, and large orthopaedic centres everywhere report decreases of 30 to 50 per cent in the incidence of bone tuberculosis. Especially noteworthy is the

diminution of severe types of lymph-node tuberculosis, particularly in large cities. Deaths from nonpulmonary tuberculosis have always been mostly among children and their decrease in the past ten or twenty years has been much greater than for the pulmonary forms,—68 per cent per 100,000 from 1904 to 1924, as compared with 56 per cent for the pulmonary. In Manchester, New Hampshire, the deaths from all nonpulmonary forms of tuberculosis in 1927 was 14, from the pulmonary forms 35. *Changes in Sex Incidence and Possible Reasons:* At present an outstanding feature in the tuberculosis death figures is a very marked excess of female over male mortality in the years of adolescence,—fifteen to nineteen. In 1924 the excess was 49 per 100,000. The females have not only failed to gain ground, but in the age period of 15–19 have lost ground startlingly. It is recalled that the physical disturbances of puberty are greater in the female than in the male; also that she has recently entered into industrial pursuits and modes of life to which she is unaccustomed. There has also been recently a tendency to "vital dissipation,"—late hours, excessive dancing, shows, movies, dieting, etc. Young females with a natural tendency to plumpness have tried to offset this natural development by a starvation diet, with disastrous results. *Changing Prevalence of Infection:* One working in this field is impressed that we have less infection than formerly. Everyone is *not* infected, as so often stated. This idea was based on studies made some time ago in Vienna, then the most notoriously tuberculous city in the world. Recent American statistics show less than half of the European incidence of infection and for the last two years are particularly low. It now appears, from New York City Health Department studies, that not over 40 per cent of children in New York are infected. Kerr, in observations in Nashua, New Hampshire, on about 600 children picked out for skin testing and roentgenographs, found only 60 per cent positive, and these were from the poorer homes. *Pulmonary Tuberculosis in Children:* Recent statistics show a very definite *increase* in the mortality from pulmonary tuberculosis in children, especially in the large industrial centres. This is true for New Hampshire to a slight extent for the age group 10–20 years. It is apparently also true for New York. Rathbun found a considerable number of open pulmonary cases among high-school students in Chatauqua County, some even among athletes. Pulmonary tuberculosis, especially in the age period 12–16 years, is probably more common than generally supposed and more often missed. Many of these cases, however, seem relatively benign. Obtaining sputum specimens in infants is referred to. Girls more often show positive sputum than boys. *Factors in Decrease of Nonpulmonary Tuberculosis:* Among these are pasteurization of milk, tuberculin testing of cattle, improved hygiene, removal of active, especially advanced, cases from contact with children, health education with reference to tuberculosis, improved economic conditions and nutrition. Pasteurization of milk and tuberculin testing of cattle come first in importance. On the other hand, the apparent increase in pulmonary tuberculosis in children seeks an explanation and there are various hypotheses. *Antituberculosis Measures:* The New Hampshire Tuberculosis Association has concentrated its resources for childhood work. It has inaugurated School Examination Clinics for those 10 per cent or more underweight or others referred for disability. At present there are under treatment in the tuberculosis clinics about 200 open cases in children and over 800 suspicious hilum cases. A preventorium is now the most urgent need. There is a children's ward for open cases at Pembroke Sanatorium, near Manchester, and Nashua maintains a splendid summer health camp for 100 boys and girls at Sunset Lake in Greenfield. The characteristics of the infantile, juvenile and adult types of the disease are referred to and summarized. The juvenile is the type which presents the golden opportunity for preventive work. Its diagnosis is not easy and often can not be positively confirmed. It is emphasized that we are not here seeking pulmonary tuberculosis as evidenced by crepitations in the lungs but lymphatic tuberculosis as shown by parasternal and paravertebral dulness. The diagnosis must be made prior to lung involvement.—*Childhood Tuberculosis and Its Relation to the Campaign for the Prevention of the Disease, R. B. Kerr, Meeting, New Hampshire Med. Soc., May 15, 1928, reported in New England J. M., October 4, 1928, cxcix, 669.*—(*A. P.*)

Active Tuberculosis in Children.—This is an analysis of the 126 cases admitted to the special tuberculosis service of the Cook County Hospital in Chicago between December 1, 1926, and January 1, 1928. All the children were under 12 years of age. Cases not manifesting active symptoms were not included. Compared with the total admissions for the period, the incidence of active tuberculosis was 7.61 per cent. The greatest aetiological factor was contact with a tuberculous parent or other relative. Measles was a predisposing cause in over half the series. In one case of tuberculous

meningitis the onset followed directly after measles. There was a preponderance of colored over white children, the proportion being 83 negro, 11 Mexican, and 25 white. (Seven cases included were readmissions.) Economic conditions, rather than race, were thought to be the determining factor in the high incidence of tuberculosis among negroes. Inasmuch as negroes live under unhygienic conditions, many people sleeping in one room, the possibility of exposure is correspondingly greater. The greatest number (69.7 per cent) were under 5 years of age. This can be explained by the fact that miliary tuberculosis constituted a large number of the cases. —a type of tuberculosis most frequent in infants. Sixty-nine of the 119 new cases were proved to have suffered from miliary tuberculosis. Most of them coughed, but in only a few of them was the cough distressing. The chest findings were vague in the majority. The study demonstrates once more that all cases of tuberculous meningitis have a generalized miliary tuberculosis and that most cases of miliary tuberculosis develop meningitis. Ninety-seven of the 119 cases had some form of pulmonary involvement. Sixty-nine were miliary in type, 15 were acute pulmonary, and 15 were subacute or chronic. The symptoms of acute pulmonary involvement were strikingly few. Some cases that had unquestionable active pulmonary tuberculosis affecting a whole lobe or even two lobes, often ran no higher temperature than 99° or 100°, and sat up in bed quite comfortably. In most cases the cough was strikingly mild. Most of the patients had afternoon sweats and night-sweats, and lost weight. Nine cases suffered from tuberculous peritonitis,—6 from the plastic, and 3 from the ascitic form. The most frequent symptoms of the plastic form were severe pain, alternating diarrhoea and constipation, and in some cases vomiting. Matted mesenteric lymph nodes were often palpable. Tuberculous pleurisy with effusion was seen three times. Most of the children had palpable cervical lymph nodes, but only a few had characteristic large masses. There were two cases with phlyctenular conjunctivitis, one with tuberculous epididymitis, six with tuberculoma of the brain, two with Pott's disease, three with hip disease, one with pectoral abscess, and one with pyelonephritis and cystitis. Most of the pulmonary cases showed a wide mediastinum on X-ray, and every pulmonary and miliary case coming to autopsy showed accompanying tracheobronchial adenitis. In 2 cases tubercle bacilli were found in the sputum, and in one case in the stomach contents. In the diagnosis of tuberculous meningitis, the determination of the sulphosalicylic-mercuric-chloride ratio, described by Tashiro and Levinson, was of great assistance. It is most significant that all the cases of miliary tuberculosis and most of the cases of other forms of acute pulmonary involvement gave negative tuberculin tests. The same was true of cases with recent measles or whooping cough. In some cases the tuberculin tests were positive on admission, but became negative when an acute pulmonary or miliary process set in. Ninety-two of the 119 cases admitted died. All the cases of miliary and acute pulmonary tuberculosis died, as did all cases with the plastic form of peritonitis. The 3 cases with the ascitic form of peritonitis are still living. In all types of tuberculosis, the younger the patient, the worse the prognosis. The hope of eradication of tuberculosis in children lies in the prevention rather than in the cure of the disease.—*A Study of Active Tuberculosis in Children, A. Levinson, Arch. Pediat., July, 1928, xlv, 390.*—*(P. J. W.)*

Epituberculosis of Lungs in Children. —Numerous factors have been thought of as aetiological agents in the production of massive infiltration of the lungs. Of these causative factors massive superinfection can usually be ruled out, especially in those children who fall ill after they have entered an institution. Mixed infection may play a part. In 4 cases sputum and stools contained staphylococci, streptococci and diplococci (but no tubercle bacilli) during illness, but these disappeared with the recovery of the patient. In two other cases intercurrent infection appeared at the onset. Predisposition of local tissues seems to play an important part in the evolution of massive infiltration. An exudative diathesis was found in 67 per cent, but aetiological relationships cannot be deduced from this fact alone. The localization of the process is not an important diagnostic sign. The clinical appearance of massive infiltration is characterized by an acute onset, with high fever, marked loss of general well-being, cyanosis, and the use of accessory organs of respiration, although occasionally there is an imperceptible onset with comparatively good health. The percussion note is impaired, but not always in proportion to the spreading process; the breath-sounds may be diminished, or bronchial, and mucous râles may be heard throughout the entire diseased side. Rapid changes in physical signs often occur, and extensive signs may remain after clinical improvement has set in. The red-cell sedimentation rate is usually accelerated. The X-ray shows an intense shadow, more peripheral than central, and

not confined to single lobes, being usually associated with shadows at the hilum. The duration and disappearance of the shadows vary a great deal. In one patient, seven and in one, nine months were sufficient for healing without residual signs. In 2, two months sufficed. In 3 the area became cirrhotic. The differential diganosis is difficult, and the history is not helpful. Predisposing or aetiological factors and the symptomatology vary but little from those of acute or chronic pneumonia. The facts (1) that massive infiltrations develop in specifically changed tissues, especially in association with irritations or intercurrent infections, and (2) that even though of great size and of long duration they may be entirely absorbed, while chronic pneumonia leads eventually to scarring and shrinking, aid in differentiating the two conditions. Occasionally massive infiltrations, if large enough to involve the entire side, may eventuate in much cirrhosis, yet this very great size of the pathological process makes chronic pneumonia improbable.—*Zur Klinik der grossen Form der Lungen infiltrierung im Kindesalter, L. Maas, Deutsche med. Whenschr., January 27, 1928, liv, 141.*—(*H. S. W.*)

Primary Complexes in School Children.—The author reports a careful statistical examination of material from the Waldesheim Sanatorium and evaluates it. The seat of the pulmonary primary complex was in the majority of cases in the right lung. Regarding the relation between the primary focus and the focus in the lymph nodes there were no uniform findings. In the majority of cases the foci were both equally large, and only secondarily were the lymph-node foci larger than the primary foci. In the majority of cases the primary focus and the lymph-node focus were on the same side, and secondarily on both sides, while only rarely did they occur on the opposite side.—*Röntgenologische Beobachtungen und klinische Überlegungen an 300 pulmonalen in Rückbildung begriffenen und rückgebildeten Primärkomplexen (Pr. K.) bei Schulkindern, K. Nüssel, Ztschr. f. Tuberk., 1928, xlix, 401.*—(*H. J. C.*)

Pulmonary and Hilum Tuberculosis in Childhood.—X-ray pictures of the chest were compared with anatomical lesions found at autopsy in order to arrive at conclusions useful for diagnosis, prognosis, and treatment of pulmonary and bronchial-node tuberculosis in children. *Lesions of the Bronchial Lymph Nodes:* Tuberculous bronchial lymph nodes are always enlarged. These enlargements frequently occur in the middle of the mediastinum, where their shadows can rarely be observed because they are usually masked by the shadows of the heart, aorta, and superior vena cava. The so called "perihilar" shadows are not produced by the lymph nodes, for these can give rise only to juxtatracheal shadows. *Lesions of the Lungs:* A study of good X-ray plates may reveal the presence of a miliary tuberculosis very early in the course of the disease, often before any other characteristic signs or symptoms have appeared. It is usual to find that pictures taken during the early stages of the disease show localized lobar shadows which may persist for months. Radiography, in series, shows that in some cases the shadows can progressively disappear, even though it has been possible to demonstrate the presence of tubercle bacilli in the sputum. In the vast majority of cases the shadows can be seen increasing progressively and to invade the other lobes of the same lung, or perhaps crossing over to the opposite side. When the case shows these later developments, the indication is for a prompt resort to collapse therapy by artificial pneumothorax.—*The Pathology of Pulmonary and Bronchial Gland Tuberculosis in Infancy and Childhood, P. F. Armand-Delille and C. Lestecquoy, Tubercle, May, 1928, ix, 359.*—(*W. I. W.*)

Alleged Tuberculous Duodenal Ulcer in Early Life.—This is an extremely rare condition and the diagnosis is usually made at operation or autopsy. The cardinal symptoms are those of ulcer of any aetiology in children or adults and may be summarized as follows: Pain in the epigastrium, discomfort, tenderness, vomiting, and haematemesis. X-ray examination of the gastrointestinal tract usually reveals the ulcer. The case reported was that of a boy aged fifteen who was treated as a neurotic for two years before exploratory laparotomy revealed chronic inflammation of the appendix and adhesions. The appendix was removed and the patient felt better for one month, after which he had a recurrence of symptoms. X-ray of the upper gastrointestinal tract showed total obstruction of the pylorus. On May 3, 1927, the red cell count was 1,920,000 and the haemoglobin 20 per cent. Blood was found in the stool. Laparotomy was again performed and a gastroenterostomy done. The entire mesentery was found studded with enlarged hard lymph nodes, some of which were removed. Convalescence was uninterrupted. Biopsy showed active caseous tuberculosis of the mesenteric lymph nodes. Because of these findings it was assumed that the duodenal ulcer was of tuberculous aetiology. One year after operation the patient's condition was judged

normal. The patient did not have active clinical tuberculosis of any other part of the body and his family history was negative for tuberculosis. The case was regarded as one of primary abdominal tuberculosis with obstructing duodenal ulcer.—*Tuberculous Duodenal Ulcer in a Boy Fifteen Years of Age, H. Cohen, M. J. & Rec., June 6, 1928, cxxvii, 611.*—(*H. McL. R.*)

Prognosis of Tuberculous Peritonitis in Childhood.—Opinions in the past have differed on this question. The older physicians, who knew hardly any but the caseous forms, regarded them very gravely. Their successors, recognizing the tuberculous nature of so called essential ascites, observed frequent cures, and tuberculous peritonitis generally came to be regarded as 80 to 90 per cent curable. The present study deals with 25 children cared for at the *Clinique médicale des enfants* from early in 1921 to the end of 1926. A certain number have been seen again and there has been news of several others. Three categories of cases are considered: *1:* Tuberculous peritonitis resulting in death, either at the hospital, or shortly after discharge. *2:* Tuberculous peritonitis lost sight of after discharge. *3:* Peritonitis cases whose distant future is known. The first group comprises 7 patients, or 28 per cent. These included both miliary and caseous forms. Among four patients dying of caseous tuberculous peritonitis were three girls, aged 13 years, 7 years, and 17 months, and a boy of 14 years. They all showed classical symptoms, such as irregular fever, with wide oscillations, marked anorexia, persistent diarrhoea, or alternating constipation and diarrhoea, and definite localizing physical signs, such as abdominal sensitiveness, deep painful masses, or diffuse thickening. Tympany above with dulness below is the rule. Autopsy was done in two cases, showing the peritoneum studded with tubercles, the intestinal coils adherent, and large tuberculous nodes in the mesentery, mediastinum and neck. There was also one case of the ascitic form and one dry with generalized tuberculosis. The second group, later lost sight of, comprised 7 patients, or 28 per cent. One of these was worse on discharge, 2 still active, with condition little changed, and 4 improved and in good condition. In these last the condition slowly and progressively improved, and the fever gradually diminished and disappeared. In one case heliotherapy seemed to help, in another exploratory puncture. The third group, comprising those followed up for a considerable time, comprises 11, or 44 per cent of the cases. Of these, 1 has died, 5 still present either peritoneal or other active tuberculous foci, and 5 are considered clinically cured. The other tuberculous foci noted included the ankle joint, inguinal lymph nodes, pelvic organs, and thoracic wall. All these patients left the service in satisfactory condition, but their tuberculosis was not cleaned up, and later reappeared. In another case a pleural exudate developed three weeks later, but was cured after three punctures. Of the 5 patients clinically cured, all had involvement of the ascitic or serous type, and accompanying pleurisies were frequent. The ages were from 7 to 13 years; 2 were boys and 3 girls. In two cases improvement was rapid and seemed to be hastened by ultraviolet radiation. In three others it was gradual, over several weeks to months. *Conclusion:* It is emphasized that of 25 patients only 5 were known to be truly clinically cured, and this state maintained over a considerable period. This proportion is only 20 per cent. The prognosis for children with tuberculous peritonitis should therefore be rather guarded. Even in healed cases, the formation of adhesions may lead to intestinal disorders, or in girls, genital troubles. The *different forms of peritoneal tuberculosis* carry the following mortality: (1) miliary, 100 per cent, (2) caseous, 100 per cent, (3) ascitic, 56 per cent, and clinical cures 35 per cent, and (4) mesenteric infiltration,—two such were improved. The above observations do not confirm the notion that an abrupt onset means a favorable prognosis. *Treatment:* In the acute phase, rest is indicated, with warm or cold compresses to the abdomen. Later, heliotherapy, fresh air, proper nourishment, and calcium medication, are recommended. Laparotomy in three cases was without result.—*L'avenir des enfants atteints de péritonite tuberculeuse, P. Nobécourt and I. Dragolioub, Rev. d. l. Tuberc., December, 1927, viii, 785.*—(*A. P.*)

Importance of Bovine Tuberculosis.—It is estimated that about 20 per cent of tuberculosis of children and about 5 per cent of all tuberculosis is of bovine origin. The bovine tubercle bacillus produces approximately 10 per cent of all deaths from tuberculosis, although it is prone to cause nonpulmonary disease. The portal of entry is practically always the intestinal tract. The bacillus is eliminated through the udder, which in 3 or 4 per cent of all cows has been found to be tuberculous, but a normal udder will readily allow it to pass. It has been shown to be present in 16 to 20 per cent of cases in Edinburgh and in 8 or 9 per cent in various cities in America. The fact that several different animals are susceptible to

the same type of tubercle bacillus, as it is transmitted spontaneously in nature, raises the question of whether the different types are not really variants of the same germ. Bovine tuberculosis may in reality be the cause of a great deal of pulmonary tuberculosis in adults. The transmission of the bovine bacillus to man can be absolutely prevented by proper pasteurization of the milk and the proper cooking of meat. It is a fact of importance, however, that much more than half the population live in localities where pasteurization is not done. Moreover, the milk that is used for making butter, cheese and other milk products is usually unpasteurized. The eradication of tuberculosis in cattle is obviously the most important single problem in the question of bovine tuberculosis and the public health. This is most efficiently realized by slaughtering tuberculous cattle from herds after their intelligent testing with tuberculin.—*Bovine Tuberculosis as a Public Health Problem, D. C. Lochead, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 823.—(H. S. W.)*

Eradication of Bovine Tuberculosis in New York State.—Very gratifying progress has been made in New York State in the eradication of tuberculosis because in the work there have been (1) a plan, (2) a sound and workable organization and (3) a program. *Outstanding Features of the Plan: 1:* All testing is confined to areas in which owners of 90 per cent of the cattle have signed up for the program. *2:* All tests are done by the ophthalmic-intracutaneous method, and all the cattle of the 90 per cent are tested. The tests should be applied to all the cattle within a short period. *3:* All reactors are branded and segregated. *4:* The reactors are then appraised. *5:* They are shipped and slaughtered, and the meat is inspected, and sold or condemned. *6:* The premises are thoroughly cleaned and disinfected according to a set of printed directions. *7:* Infected herds are retested every sixty to ninety days until free from reaction, and thereafter every six months until the herds are accredited, which comes about after there have been no reactors for one and a half to two years. *8:* All new cattle brought into accredited herds must originate in accredited herds. *9:* After tests are completed, a quarantine is laid, prohibiting movement to or through the area of cattle not tested within the last sixty days and found to be reaction-free. *10:* Annual testing is made of accredited herds. *11:* Supervision of field activities is done by inspectors. This plan, in operation for two years, has already yielded decidedly satisfactory results. *The Organization:* This consists of the coöperative work of the United States Bureau of Animal Industry, New York State Department of Agriculture and Markets, 42 local boards of supervisors, 50 local county tuberculosis committees, farm bureaus and cattle owners, and consumers of dairy products. *The Program:* Sporadic testing is entirely done away with. The township is the unit of operation. Forty-eight of the 62 counties of the State have raised $225,000 during the last year for the work. Each county is recorded as being "organized" if it has an appropriation, a committee and a paid veterinarian. The average net salvage value of reactors that were killed in 1921 was $14.50, and in 1927 it was $35.03, the increase being brought about through a uniform system of appraisal and coöperative slaughter and sales. Last year more than 800,000 cattle were tested in this program, and 67,202 were found to be reactors. Nine hundred and nine animals reacted very slightly to tuberculin and were killed. Of these, 52 had generalized disease 641 had localized disease, and 215 had no visible lesions. At present there are 176,000 herds in New York State, with a total of 2,016,000 dairy cattle. There are 43,120 accredited herds (409,444 cattle), 15,993 infected herds (210,796 cattle), and 101,011 herds (1,033,095 cattle) under the plan. Demonstrations of tuberculin-testing and interpreting have been helpful. From 1918 to the present (calendar year 1927) more than $19,500,000 has been appropriated for indemnity purposes. The continuation of the present organization will allow the State to be entirely "once-tested" by 1933 and accredited by 1936.—*The Progress New York Has Made in the Eradication of Bovine Tuberculosis, E. T. Faulder, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 771.—(H. S. W.)*

National Tuberculosis Eradication in Cattle.—During the little more than ten years of its existence the Tuberculosis Eradication Division of the Bureau of Animal Industry has brought about a vast improvement in the incidence of tuberculosis. In 1917, 2.4 per cent of the cattle and 10 per cent of the hogs in the United States were infected with the tubercle bacillus. In 1927, 1.1 per cent of cattle and 13.5 per cent of hogs reacted to tuberculin. In 1917, 204 herds were accredited; in 1927, 142,500 herds (nearly two million cattle) were accredited; and there are now 1,650,000 (13,600,000 cattle) "once-tested-free" herds. The circumscribed area-testing plan has worked well and has become widely applied. The Bureau has investigated the incidence of avian tuberculosis in regions where the disease was thought to be relatively scarce.

Of 39 states in which tuberculin tests were done, 27 reported some form of poultry disease, about 25 per cent of which was tuberculosis. Eighty-five thousand birds were tested and 9,300 were found to be reactors. Farm flocks are now examined in many regions at the time cattle are being tested. During 1927 over 16,500,000 fowls were examined, about 6 per cent of which were infected. The questions of care and proper technique in tuberculin-testing and of salvaging and indemnity continue to be important. For the latter purposes the Federal Government has appropriated $18,-500,000 for the current fiscal year. The Bureau administration is optimistic over the progress that has been made.—*A General Survey of the National Tuberculosis Eradication Work, A. E. Wight, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 864.—(H. S. W.)*

Eradication of Bovine and Avian Tuberculosis.—There has been a definite awakening of public interest in the tuberculin testing of cattle. In the central states there are more than 16,000,000 cattle and 25,000,000 hogs, and the problem of the eradication of tuberculosis from these is a large one. The payment of a 10 per cent premium per hundredweight for hogs marketed from counties in which tuberculosis has been eradicated has paid the farmer more than the cost of the eradication program. The market for tested cattle becomes more attractive and that for untested cattle less attractive, and this fact makes the problem of eradication less complex yearly because the people now want the disease eradicated. Incidentally, the average cost of the test has been reduced to 33 cents per head. But a word of caution is needed at this time against careless testing, inadequacy of cleaning and disinfecting premises, failure to explain to the owners the importance of slaughtering the reactors, and failure to broad-cast information of the progress that is being made.—*Tuberculosis Eradication Work in the Central States, J. A. Barger, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 842.—(H. S. W.)*

Skin Lesions in Tuberculin-Reacting Cattle.—The incidence of cutaneous lesions in tuberculin-reacting cattle varies from 5 to 60 per cent in different localities, and appears to depend upon the general sanitary care of the premises where the cattle are kept. It is likely that manure which becomes caked on the cow produces irritation and inflammation, with the formation of fissures that may become infected with tubercle bacilli. The areas appear in situations most commonly soiled by manure. They are nodular and of a great variety of sizes; they may be situated either in or just under the skin and may discharge pus; healing and calcification may occur. In 60 per cent of them acid-fast bacilli have been found. In all but two instances, attempts to cultivate these bacteria have failed: in those two the bacteria were nonpathogenic. Large numbers of guinea pigs have been inoculated, but none developed tuberculosis, which has led to the thought that the bacilli in such superficial lesions may have lost much of their virulence. With this in mind, guinea pigs (number not given) that were inoculated with material from the lesions were allowed to live 5 to 7 months, when at autopsy enlarged lymph nodes, with typical tuberculous tissue in them and acid-fast bacilli in the liver and spleen, were found, while guinea pigs similarly inoculated, but killed 12 or 14 weeks afterward, revealed no such changes. Young calves and four pigs were inoculated with suspensions made from skin lesions of reacting cattle in which no other signs of disease were found at autopsy. Acid-fast bacilli were detectable in these lesions. The animals remained "tuberculin-negative," and six months after inoculation were found at autopsy to be free from tuberculosis. Another lot of 6 calves were inoculated similarly from such skin lesions. In only one instance did tuberculin hypersensitiveness develop, and this was transient. None showed tuberculosis at postmortem examination except the reactor, which had well-marked tuberculosis of the mediastinal lymph-nodes. It is singular that the one calf to develop hypersensitiveness was inoculated with material from the only "donor" which failed to react. In the mediastinal lymph nodes in the reacting calf many acid-fact bacilli were present, and of this tissue, a suspension was made and inoculated into 7 guinea pigs and one rabbit, all of which were dead with tuberculosis within 70 days of the inoculation. One knows of no bacteria except the tubercle bacillus that has the property of producing such areas of disease as those seen in the skin of these reacting cattle, and it is altogether probable that such bacilli are the cause of these nodules. Much more work is necessary for the elucidation of this question.—*Skin Lesions in Tuberculin-Reacting Cattle, L. E. Day, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 782.—(H. S. W.)*

Tuberculosis of Skin in Cattle.—So called "skin-lesion" tuberculosis in cattle has been thought to be caused by some other acid-fast form than the tubercle bacillus. The opinion is based on the following facts:

(1) Such instances are sometimes found in birds with no history of tuberculosis; (2) acid-fast microörganisms are usually present in the lesions but they fail to grow on media which sustain tubercle bacilli: (3) such animals often react atypically to mammalian tuberculin; and (4) the condition varies as to prevalence in different localities. It has been shown that guinea pigs react constantly and fairly well to mammalian tuberculin when they have been inoculated with either timothy, dung, or "hog-skin" bacilli. In the experiments reported 6 calves were employed, three of which were inoculated, each with one of the strains of nonpathogenic bacteria just mentioned; the remaining three were inoculated, one with avian, one with bovine and one with human tubercle bacilli. Inoculation was done by rubbing suspensions of bacilli into scarified areas of the skin. At the site of inoculation, at one month, hair had grown, and no trace of the inoculation remained. At 35 days the scarified areas on the animal inoculated with bovine bacilli were slightly thickened, dry, and roughened, which at 2½ months had practically disappeared. The 6 animals, all of which had been negative to tuberculin at the beginning of the experiment, were tested at its termination, and none save the one infected with bovine tubercle bacilli reacted. This one at autopsy had numerous tuberculous lymph nodes containing tubercle bacilli that were lethal for guinea pigs. The remaining 5 animals were again inoculated, each with the same strain as before and about 4½ months after the first dose, the route being intracutaneous. These inoculations led to no visible lesions and no hypersensitiveness to tuberculin. Later, subcutaneous inoculation of the same strains into the same animals likewise resulted in no reaction in any animal except the one receiving bovine bacilli, and in this one a transient, indurated ulcer appeared. Tuberculin tests were negative in all animals, however, four months after the last dose. The number of animals is too small to justify deductions, but it would appear that none of the bacteria used bore any causal relation to "skin-lesion" tuberculosis. In about 20 different sets of skin lesions, acid-fast bacteria, which will neither grow on media nor infected animals, have been found. Were such bacteria dead or attenuated? Or did the affected cattle possess an inherent or acquired susceptibility? If we assume that these bacteria were bovine tubercle bacilli, we cannot suppose that they were dead, for, although many tubercle bacilli undoubtedly die in lesions, such tissue will invariably infect animals when inoculated into them. There is likewise no reliable evidence that tubercle bacilli ever undergo attenuation. The situation in respect to growing bacteria from the skin lesions is similar to that in leprosy and in Johne's disease. Data regarding the relation between simultaneous "skin" and internal lesions may be cited as follows: Of 1,075 animals in 28 herds, 59 reactors were found to have both internal and "skin" lesions; among 655 animals in 10 herds 41 reactors were present, both types of lesion were found, but in different animals; in 38 herds (1,588 animals) 60 reacted but showed only "skin" lesions, but in 11 of these herds there had never been a history of tuberculosis. The so called "skin" lesions are in reality subcutaneous lesions which come to involve the skin. Therefore, it is proposed that the term "subcutaneous tubercular nodule" be used in describing this condition. —*Studies in So Called "Skin-Lesion" Tuberculosis, A. B. Crawford, J. Am. Vet. Med. Assn., June, 1928, lxxiii, 216.*—(*H. S. W.*)

Diagnostic Use of Johnin in Cattle.—Johne's disease, a specific, chronic, infectious disease of cattle, and characterized by persistent diarrhoea, is caused by Johne's acid-fast bacillus, and is probably more prevalent throughout the country than has been supposed. Once introduced into a herd, the disease leads to a death-rate of from 2 to 12 per cent annually, as well as to considerable nonproduction of milk. No cure is known. Clinically it cannot be diagnosed until symptoms become apparent, which is nearly always months after the onset. Some diagnostic agent is, therefore, particularly desirable. Numerous efforts have been made to prepare a "tuberculin-like" substance from the bacillus of Johne, but many of these have failed because of the necessity of adding extracts of other acid-fast bacteria or products from them to the culture media in order to facilitate growth of this bacillus. In an effort to avoid such obvious objections, a preparation has now been made by growing Johne's bacillus on the synthetic protein-free medium devised by Long a few years ago. To this medium is added 0.2 per cent timothy bacilli that have been grown on glycerine broth and killed by heat. The bottles of medium are then incubated for one week, when, if sterile, they are seeded with Johne's bacillus and incubated for from four to six months. At this time the bacteria are passed through a Buchner filter, collected, treated with ether, and then extracted with water. This extract is then passed through a Berkefeld filter and mixed with the original filtrate. No heat is used in the process. The final product, called *Johnin* has been used to test cattle in several parts of the country in which Johne's disease has been

prevalent. Of 343 such cattle so far tested, 91, or 26.5 per cent, reacted to the product, 51 were "suspicious," and 193 (56 per cent failed to react. The Johnin was injected intravenously in amounts of 5 cc., and the febrile reaction which followed was recorded. An elevation of 1.5°F. was interpreted as a positive reaction. Noninfected cattle do not react. The fever usually reaches its maximum at about 4 hours. The use of Johnin prepared in this way should be of great diagnostic value.—*Johnin as a Diagnostic Agent in Paratuberculosis, H. K. Wright, J. Am. Vet. Med. Assn., April, 1928, lxxii (n.s. xxv), 1036.—(H. S. W.)*

Diagnostic Application of Johnin.—The application of Johnin, either intravenously or subcutaneously, will indicate Johne's disease before Johne's bacillus can be detected in the faeces or rectal scrapings. Of 18 animals in a herd known to have the disease, 15 gave definite reactions. Of 20 animals out of a tuberculous herd with no history of Johne's disease, 18 failed to react and two presented questionable reactions. Both of these latter animals at autopsy were found to have generalized miliary tuberculosis. The test may be followed by a slight elevation in temperature. If eleven or twelve weeks elapse between Johnin tests in an animal, no effect of the former test upon subsequent tests is apparent.—*Results Obtained by the Use of Johnin in Cattle, H. W. Turner, J. Am. Vet. Med. Assn., April, 1928, lxxii (n.s.), 1061.—(H. S. W.)*

Treatment of Johne's Disease with Chaulmoogra Oil.—Three cows with Johne's disease were treated with chaulmoogra oil by mouth in doses varying from 1 to 5 cc. daily, the drug usually being suspended in some other oil such as ordinary mineral oil. One animal, which was very ill, died within the first week of treatment. The other two, one of them having Johne's bacillus in the faeces and both of them showing clinical symptoms of the disease, began promptly to improve; and both were clinically normal and healthy after three months' treatment. Chaulmoogra oil is offered as a possible cure in the hope that it will be more extensively employed.—*A Possible Cure for Johne's Disease, W. W. Williams, J. Am. Vet. Med. Assn., April, 1928, lxxii (n.s. xxv), 1070.—(H. S. W.)*

Avian Tuberculosis.—Formerly it was thought to be cheaper to destroy diseased fowls or flocks than to prevent disease in them. More recently a great deal of attention has been paid to diseases of poultry, especially such infections as tuberculosis. It is known that avian tuberculosis is being spread to swine, and by them, and that the disease is becoming increasingly prevalent among fowls. In 1927, 211,675 flocks (16,500,000 fowls) in 34 states were inspected. Of these, approximately 12,000, or 5.7 per cent, were found to be tuberculous. As a result of this experience the Bureau of Animal Industry sent out a questionnaire, which was answered by 3,100 owners in 43 states. The questionnaire sought to ascertain something as to the conditions of maintenance and the relation between such maintenance and the incidence and spread of disease from flock to flock. The answers revealed (1) that the industry is not fully informed about avian tuberculosis and that much educational work is necessary in this regard, and (2) that no definite conclusions can be arrived at as to the most common mode of transmission of avian tuberculosis from flock to flock. The returns from the questionnaire revealed the incidence of avian tuberculosis in the different parts of the country. From them it was evident that the eastern and southern states are comparatively free from the disease, but that in the middle western states, where one-half the nation's chickens are located, the disease is alarmingly prevalent. The control measures being introduced include the education of the poultry-raiser as to the need of sanitation, and the best poultry husbandry methods, inspection of flocks, tuberculin-testing, killing of diseased flocks, and cleaning and disinfecting premises, the careful selection of healthy birds, and the raising of new flocks in new or disinfected ground. The methods will likely change from time to time. The poultry owners are coöperating well in general.—*From a Section on Avian Tuberculosis in: The Control of Poultry Diseases in the United States, J. R. Mohler, J. Am. Vet. Med. Assn., February, 1928, lxxii (n.s. xxv), 558.—(H. S. W.)*

Avian Tuberculosis.—Tuberculosis may affect all types of domestic fowls and many wild fowls in captivity. It is most common in chickens and turkeys. It is transmitted from fowl to fowl, either directly or indirectly. Trimmings and offal of infected fowls may be put into the garbage and this fed to healthy chickens. Rats, mice, sparrows and pigeons may act as intermediaries, the former being passive carriers and the latter either passive carriers or themselves subjects of the disease. Faeces is a very common agency of transmission, for the avian tubercle bacillus is shed in large numbers from the intestinal tract, and may readily contaminate the food and drink of a flock. Pathologically, the

tubercle is the characteristic lesion. There is often extensive necrosis, but only rarely is there liquid pus, and never calcification of the diseased area. The disease is chiefly abdominal, involving the intestines, peritoneum and abdominal viscera, especially the liver and spleen. The omentum is occasionally involved. It is singular, however, that the lymphatic system does not appear to be involved. No nodules are to be found in tuberculous fowls at points where lymph nodes should be, and it seems that the lymphatic system of birds is not well developed. All intestinal lesions appear to be nodular, the nodules ranging in size from that of a pin's head to that of a hen's egg. They are imbedded in the wall and communicate with the liver by fistulous tracts, which may be responsible for the continuous presence of bacilli in faeces. In some sections the disease is so prevalent and deadly that the economic loss from it is probably greater than that from bovine tuberculosis. The bacillus may set up disease in various domestic animals. It is known to do so in swine; so much so as to amount to 21 per cent of all hogs slaughtered in some states. The eradication of tuberculosis in swine must go hand in hand with that in fowl or both schemes will fail.—*Avian Tuberculosis, E. L. Stubbs, J. Am. Vet. Med. Assn., February, 1928, lxxii, (n.s. xxv), 631.*—(*H. S. W.*)

Experimental Studies on Avian Tuberculosis.—When young pigs from 6 to 10 weeks of age are put in enclosures that contain tuberculous chickens above on lattice-bottomed floors, 80 per cent of them become infected. When young pigs are fed once or twice with ground tuberculous organs or carcasses, about the same percentage suffer infection. Eight nursing pigs with access to a poultry yard harboring tuberculous birds all became infected after 45 days of such exposure. Of 30 specimens of localized tuberculous lesions (nonexperimental), 88.5 per cent were found to be of avian origin. Avian tuberculosis in swine is a *localized* disease, irrespective of the portal of entry. The diseased areas are usually slight and confined to the mesenteric or retropharyngeal lymph nodes. In order to study the question of transmission under natural conditions, a barnyard 108 x 38 x 8 feet was fenced in, so that birds could not enter or leave. For four years it has been stocked with an average of 72 tuberculous chickens, to which have been added from time to time several head of young cattle, many pigeons and English sparrows, a yearling colt, and several young pigs. Some young chickens were raised in the yard. Three-fourths of the cattle became sensitive to avian but none to mammalian tuberculin. However, at 2 to 5 months after removal from the barnyard this hypersensitiveness had disappeared. Several animals were returned to the yard a second and a third year, and each time they developed a transient hypersensitiveness to avian tuberculin. At autopsy, except in 2 animals, no lesions were found after exhaustive search, and in these two they were very scanty. During 4 years of the experiment, 300 pigeons and 200 sparrows cohabited with the chickens. When these came to autopsy, no sparrows and less than 3 per cent of the pigeons (about the average normally found) had signs of tuberculous infection. During the winter months (November 1 to April 1) the stock was removed, and the yard locked and left to the elements. Then in the early spring about two dozen tuberculosis-free chickens and a few healthy young swine were put into the yard for 45 to 60 days. Infection, as evidenced by positive tuberculin test and autopsy, developed in from 17 to 35 per cent of the chickens and in from 33 to 70 per cent of the pigs during the three years of the experiment. Rats, barn mice and field mice were next fed with large amounts of tuberculous fowl and even with cultures of avian tubercle bacilli, and large numbers were kept in contact with heavily infected flocks for over a year, with results in each instance that were entirely negative. But are rodents, sparrows, etc., mechanical carriers? Experiments have proved that rats, pigeons and sparrows carry infection from a diseased to a healthy flock, the rats carrying the bacilli in the intestinal tract. In an effort to ascertain the minimal doses of avian tubercle bacilli required to sensitize cattle, several animals were inoculated with avian tubercle bacilli (1.0 to 0.0001 mgm.) either by instilling the conjunctival sac or by rubbing into scarified skin. With the smallest doses about one-half the cattle, and with the larger doses about 80 per cent became sensitive. Of 100 head of cattle, from 2 weeks to 12 years old, inoculated with 0.0001 mgm. of avian tubercle bacilli, 20 became hypersensitive to avian (but not to bovine) tuberculin. This would indicate that cattle are highly susceptible to avian virus, although such infection is relatively harmless to the animals. To what extent, then, are cattle infected with this germ? Of 507 ordinary cattle for eventual slaughter, which were tested simultaneously with avian and bovine tuberculin, 79 (15.5 per cent) reacted to avian while only two reacted to bovine tuberculin. All cattle used for experimental purposes at the North Dakota Agricultural College for the last two years have been tested with avian tuberculin, and 25 per cent of them have reacted. Annual

or semiannual testing, followed by removal of all reactors and thorough cleaning and disinfection of premises, will greatly lessen the incidence of tuberculosis (20 to 12 per cent in a large number of observations) but will not lead to complete eradication. Is this in part because of unusual viability of avian bacilli in faeces, dead carcasses, etc.? Several infected carcasses were buried at different depths in the soil, manure piles, etc. Avian tubercle bacilli were found to be alive and virulent at 6, 9 and even 12 months later. Other carcasses were left lying on the ground where fly maggots developed after several months; these were fed to two healthy chickens one of which acquired tuberculosis. Angle worms kept for 4 weeks in soil rich in avian bacilli and then in clean soils for an equal time, failed to infect fowls when fed to them.—*Results of Some Avian Tuberculosis Studies, A. F. Schalk, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 852.—(H. S. W.)*

Transmission of Avian Tuberculosis through Eggs.—It is now known that eggs artificially infected with avian tubercle bacilli will hatch; that tubercle bacilli may be recovered from a substantial percentage of such eggs; and that chicks hatched from such eggs may show tuberculosis. But naturally infected eggs are of importance in the transmission of disease only in proportion to their hatchability. In the present study attention was paid to such questions as (1) the hatchability of artificially infected eggs; (2) the extent of infection and the mortality rate of infected chicks (hatched from artificially infected eggs); (3) the actual transmission of tuberculosis through naturally infected eggs, the transmission being determined by tuberculin tests and autopsy; (4) the influence of tuberculosis on egg-production; and (5) the incidence of tuberculosis in the ovary and oviduct. Eggs were infected by puncturing the shell with a 26-gauge needle, ¼ inch from the end opposite the air-sac. One drop of a milky suspension of virulent avian tubercle bacilli in solution was inoculated into the albuminous portion of the egg. The area was then sealed with celloidin. In an effort to ascertain the effect of such a puncture and injection upon the hatchability of eggs, normal salt solution was injected into 81 eggs by this technique, and these were incubated with an equal number of normal uninjected eggs. The number that hatched was the same in the two groups. Of 78 infected eggs, however, the hatchability was only about half that of an equal number of normal controls. Of the 14 chicks that hatched from the infected eggs all but one (which lived to maturity) died in the first two weeks of life, and tubercle bacilli, without lesions except for miliary seeding in one chick, were found in all of them. The surviving bird gave a reaction to tuberculin at the age of four months and at autopsy showed generalized tuberculosis. In 20 of the 78 infected eggs it was found that fertility existed, but that the embryos were dead. In a study of the transmission by means of naturally infected eggs, 145 hens were procured which reacted to tuberculin; and the eggs from each were identified and incubated; and the young were properly marked and, when old enough, were tested and later autopsied. The hens were ultimately grouped into three classes: (1) those that produced chicks, (2) those whose eggs failed to hatch, and (3) those that failed to lay, the latter two groups being useful for purposes of comparison. From the first group (88 hens) a total of 2000 eggs yielded a hatch of 697 chicks, of which 478 died and were examined bacteriologically with great care. The 209 that lived were tested with tuberculin and autopsied. In none of the entire yield of chicks was tuberculosis detected. The 88 hens, when autopsied, showed a mild grade of disease in 90 per cent. Those with severe disease were usually those that had laid but few eggs. Two of the hens had tuberculosis of the ovary and oviduct. The only egg laid by one of these two hatched, and the chick was normal. Whether hens with ovarian tuberculosis lay many eggs has not been determined. The hens which produced eggs that did not hatch were found to be in about the same condition as regards their tuberculosis as those in the group just mentioned. Of those which failed to lay eggs several had extensive tuberculosis. The conclusion is evident from such experiments that the transmission of avian tuberculosis through eggs is of so little significance that it may be disregarded because of the fact that birds with extensive tuberculosis lay but few eggs and a good proportion of those that are laid do not hatch. Tuberculous hens have tuberculosis of the ovary or oviduct in not more than 1 per cent. It is patent from the experiments on artificially infected eggs, if interpreted in terms of natural infection, that the death-rate of chicks while still embryonic is high, and the post-hatch rate extraordinarily high. It is to be borne in mind, however, that eggs do occasionally contain tubercle bacilli, which increase greatly in number during incubation. Such eggs if fed uncooked to chickens or pigs will produce infection.—*Completed Experiments to Determine whether Avian Tuberculosis Can Be Transmitted through*

the Eggs of Tuberculous Fowls, C. P. Fitch and R. E. Lubbehusen, J. Am. Vet. Med. Assn., February, 1928, lxxii (n.s. xxv), 636.—(H. S. W.)

Tuberculin-Testing of Poultry in Nebraska.—In four different precincts in Nebraska 60 per cent or more of all the chickens are tested with tuberculin. Two hundred and ninety-one flocks (over 40,000 fowls) were tested. Of these, 216 (74.3 per cent) contained reactors, the total number of which represented about 10 per cent of all birds tested. It is interesting that of the reactors by far the largest percentage (3 to 17) were older than one year. The testing shows the advantage of tuberculin over that of physical examination in detecting infected birds, for many of the chickens which reacted to tuberculin would have passed the most scrutinizing examination. This experience, especially with the slaughtering and inspection of reactors, points out the fact that poultry inspection, in much the same way as the inspection of meat, may be economically possible, although certain factors make this impracticable at present. The cost of tuberculin-testing is relatively great, but the annual profit to the State from the poultry industry is great enough for it to easily afford this method of eliminating so deadly a menace as this has come to be. Flock owners should be advised to keep no stock older than two years, or older than one year if there is infection in the flock.—*A Report of Tuberculin-Testing of Poultry Flocks in Nebraska, C. H. Hays, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 880.—(H. S. W.)*

Control of Avian Tuberculosis.—The increase in the incidence of avian tuberculosis has led to the inspection and tuberculin-testing of flocks at the same time that the veterinarian inspects and tests the herds in a given region. In certain parts of Wisconsin this has been followed up by an educational campaign in which postmortem demonstrations were carried out both on the farms and at public gatherings arranged for the purpose. Poultry raisers were urged to begin new flocks in new quarters with incubator chicks.—*The Control and Eradication of Avian Tuberculosis by Education and Sanitary Measures, A. J. Knilans, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 819.—(H. S. W.)*

Eradication of Avian Tuberculosis.—It is only recently that much attention has been paid to tuberculosis in poultry. In Michigan the flocks are inspected at least twice, and information and directions are given to the owners. Second visits have been made to 286 infected poultry farms, on 60 per cent of which the Department's recommendations had been carried out. Most of the infected flocks are in one section of the State, where for several years owners have imported new stock in an effort to improve their breeds. The elimination of infected stock depends largely upon educating the flock-owner as to the proper methods of procedure. If a flock is of valuable pure-bred birds, the tuberculin test is advised. Any reactors are removed, and the premises then thoroughly cleaned up. Additions to the flock should be kept separate from the original stock, and tuberculin tests are to be repeated every six months. If the infected flock is one of average chickens, it is practical to consider the entire flock tuberculous, and the owner is advised to kill and burn all suspicious fowls found each day, and to keep the premises clean until the end of the first laying season, at which time the entire flock should be disposed of. The place should then be thoroughly cleaned and disinfected and a new flock begun. It is not impossible by this means to eliminate tuberculosis from the farm flock, but a serious problem arises when the farmer asks for advice as to where he can procure fowls that are free from the disease. The sale of poultry for "flock-building" should be so regulated that only these known to be free from tuberculosis are purchasable.—*Practical Method of Eliminating Tuberculosis from Farm Poultry Flocks, T. S. Rich, J. Am. Vet. Med. Assn., March, 1928, lxxii (n.s. xxv), 787.—(H. S. W.)*

Tattooing Hogs in Eradication of Tuberculosis.—The average loss from tuberculosis in slaughtering hogs is about 10 per cent. The 10 per cent premium paid to producers in accredited areas represents a moderate loss to the buyer, because even in such districts, the loss is usually about 3 per cent. Avian tuberculosis is probably responsible for a good deal of this. Two large packers paid $300,000 in premiums last year. Hogs from accredited counties must be tattooed, in order to allow adequate recording and studying of results. A tattooing system which identifies the individual producer will enable one to check the reactors or infected animals that may have escaped detection.—*Tattooing Hogs as an Aid in More Complete Eradication of Tuberculosis, H. R. Smith, J. Am. Vet. Med. Assn., March, 1928, lxxii n.s. (xxv), 846.—(H. S. W.)*

Protective Inoculation with BCG.—During the latter part of 1924 Domingo

began a series of experiments, to verify Calmette's results with *BCG*. The work included a study of the local infection produced by *BCG* in the rabbit, and the course of the ensuing lesions. *Local Infection by Injection of Vaccine:* The *BCG* was suspended in glucoglycerine and introduced into the rabbit's ear, where both vascular and lymphatic changes could be easily observed. In the first series of 15 animals, inoculated with 1 cc., the phases of oedema, phlegmonous reaction and formation of suppurative foci were observed. A nodule developed and reached its maximum about the fourteenth day, when the congestive zone almost completely disappeared. Resolution occurred by external discharge of the contents, followed by cicatrization. In no case did the ordinary chronic tuberculous ulcers form. At the end of six hours an enormous phagocytosis was detectable. After three or four days the monocytes appeared, and at the end of a month they were abundant, with much cellular debris and acid-fast granulations, in place of the ordinary bacilli, which had at first been numerous. Cultures on glycerinated potato and Petroff's medium were positive. As to the persistence of infection, among a lot of 20 animals, infected December, 1924, two are still alive, the last anatomical lesions being observed in November, 1926. Eight presented lesions before the end of the fifth month, 6 during the eighth and ninth months, and 4 died of nontuberculous causes. The effect of reinoculations was also studied. Reactions seemed to occur earlier, and the original lesion also seemed to increase temporarily. The same phenomenon occurred when virulent bacilli were injected. Intercurrent infections were not observed to induce generalized infection by *BCG*. *Clinical Observations:* From November 6, 1924, to March 6, 1927, 203 infants were vaccinated. The vaccine was made up every eight days, administered during the first ten or twelve days of life, usually the third, fifth, and seventh, or fourth, sixth and eighth, orally, in a sterile spoon containing mother's milk, a half hour before nursing. In every instance it was attempted to improve home conditions and separation from tuberculous parents was urged if they were very contagious. The children were examined twice a year, and in many cases roentgenographed and skin-tested by the Mantoux method with 0.2 cc. of 1–5000 Old Tuberculin. From November, 1924, to September, 1926, there were 158 children vaccinated, of whom 134 could be followed. Of these 72 were maternally fed, 20 artificially, 16 both ways, 26 wet-nursed. *Results:* These 134 children were classified thus: *Group I:* 45 children observed for eighteen months. *Group II:* 47 children observed for twelve months. *Group III:* 42 children observed for six months. These were subdivided as follows: *A:* Exposed to contagion. *B:* Born in families apparently free from tuberculosis. Group A was again subdivided into the following: *Group M:* (a) Offspring of tuberculous mothers who had marked activity of the disease during pregnancy, and not separated from the mother before, during or after vaccination; (b) offspring of a seriously affected father, having been in intimate contact (same bed) since birth; (c) infants who had lived more or less intimately from birth with a parent with a severe contagious process, with many avenues of transmission, favorable to massive infection. *Group P:* Including (a) children with a parent or intimate relative with a fibrous process with intermittent bacillary elimination; (b) those with relatives having so called "benign septicaemic forms" of the disease, (lymphatic, osseous, cutaneous and pulmonary fibroid lesions); (c) those with relatives who originally had serious disease but responded to treatment and in whom bacillary elimination was inconstant or nil. All this group have therefore presumably been subject to slight infection. The results have been classified as follows: *1:* Those dead of a tuberculous process proved at autopsy, or by indubitable clinical evidence, denoted by $+T$. *2:* Those dead of a process probably tuberculous, as indicated by the clinical evidence, denoted by $+p.t.$ *3:* Those dead of other proved causes, denoted by $+a.c.$ *4:* Children of subnormal development, with some suggestive manifestations, digestive, respiratory or lymphatic, denoted by $\pm$. *5:* Children who have developed normally and had but slight indispositions, denoted by $+$. *6:* Children whose weight, development, etc., have been normal or above, denoted by $++$. *A: Contagion Occurring through the Father: M: Massive:* Five cases, of which 2 died of tuberculous or presumably tuberculous causes, and 2 came in the $\pm$ group. *P: Probably "Paucibacillary":* Thirteen cases, of which 7 came in the $++$ group, 5 in the $+$ group, and 1 in the $\pm$ group. *B: Contagion Occurring through the Mother: M: Massive:* Fourteen cases, of which 10 died; the other 4 were separated at birth and placed in the country, and are now well. *P: Probably "Paucibacillary":* Fifty-six cases of which 27 came in the $++$ group, 20 in the $+$ group, 3 in $\pm\pm$, and 5 in the $+a.c.$ *C: Contagion Occurring through Other Persons:* This did not appear to be nearly as dangerous, judging from the statistics of a very few cases. *Summary of Results in*

Exposed Cases: M: Massive: Twenty-eight cases, of which 7 came into the ++ group (normal or above), 5 into the + group (approximately normal), 4 into the ± borderline group, 7 into the known or definitely tuberculous group, +*t* and +*p.t.* and the rest, 5, into the *a.c.* group. *B: Probably "Paucibacillary":* One hundred and thirteen cases, of which 85 came into the normal, above normal or approximately normal group, 8 into the ± borderline group, and 8 into the known or probably tuberculous group. This gives a percentage of about 75 per cent of normal or excellent development, 7 per cent delicate, and 7 per cent dead of known or presumable tuberculous causes. *Results in Cases without Known Exposure:* There were 21 of these followed, none of whom died of tuberculous or probably tuberculous causes, one is in delicate health, and 15 in normal or excellent health. Protocols of necropsies together with summaries of the clinical histories of those children who died are cited. *Cutaneous Reactions to Tuberculin in Vaccinated Children:* In 53 children of different groups tuberculin tests were made, in 46 the intracutaneous, using 0.2 cc. of 1–5000 T. A., and in 7 the Pirquet technique. In group M there were 10 positive and 6 negative reactions, in group P 9 positive and 22 negative. This proportion is 62 per cent positive for the massive-exposure group, and 29 per cent for the "paucibacillary." The frequency of positive reactions from the third month on is apparently greater for those living under unfavorable conditions. The reaction must be interpreted with caution, agreeing with the dictum of Calmette and Weill-Hallé that "a positive cutaneous reaction in a vaccinated child is not necessarily to be interpreted, as in the nonvaccinated, as the expression of active infection or disease (from 0 to 2 years)." *Analysis of Results:* The innocuousness of the vaccine seems proved. No unfavorable reactions attributable to it occurred, except in children who had evidently already been infected, and in whom there were manifestations of intolerance. The effectiveness of the vaccine seems largely dependent on protecting the child from massive infection immediately before and after its administration. The definite and probable tuberculosis mortality in the vaccinated, however, is only 6.2 per cent, as compared with 23 per cent tuberculosis mortality in the nonvaccinated of the same age, and the proportion who showed clinical signs of tuberculosis (among those in contact with the tuberculous) was 3 per cent from 0 to 2 years in the vaccinated, compared with 56 per cent in the nonvaccinated. Calmette's conclusions as to its effectiveness are therefore reaffirmed.—*Première série d'observations sur la vaccination antituberculeuse de Calmette, L. Sayé, P. Domingo and M. Mirabelli, Rev. d. l. Tuberc., October, 1927, viii, 668.*—(*A. P.*)

Protective Inoculation with BCG.—Van den Branden summarizes work done at Stanleypool, the attenuated tubercle-bacillus culture being furnished by the Pasteur Institute of Dakar. The vaccine was given *per os* to children from a week to a year old. No tuberculous infection has been found at Leopoldville in children under four years. *Preparation and Dosage:* Three doses of 0.01 gm. of *BCG*, totalling 1,200,000 bacilli were given on alternate days. The attenuated culture was grown for 25 days on glycerinated potato. The bacilli were dried on sterile filter paper, weighed, and then placed in a sac containing glass beads and shaken, after which they were diluted to a strength of 1 cgm. per 2 cc., made homogeneous in suspension, and transferred to sterile ampules, which were sealed. The diluting fluid contained 4 per cent glycerine in 1 per cent glucose in distilled water, and mixes readily with simple syrup. The number of children vaccinated was two hundred, 100 at West Leopoldville (Old Leopoldville), and 100 at East Leopoldville (Kinshasa). *Untoward Sequellae:* In one child vaccinated a month after birth, there was discovered, about four weeks after vaccination, a swelling below the angle of the scapula to the left of the spine. A small amount of yellow creamy pus was aspirated, and inoculated intraperitoneally into a guinea pig without any local effect, and the animal was living four months later. One child of three years was vaccinated, whose father had suffered from open pulmonary tuberculosis for over three years, but the child gave two negative cutireactions. Eight months later it showed multiple periostitis and a cold abscess of a rib. Doubtless the child was already infected and the vaccine should not be incriminated. One attempt to vaccinate young military recruits was abandoned because the garrison was so often changed. Altogether 30 recruits, with negative cutireactions, were vaccinated without mishaps.—*Essais de prémunition par le vaccin bilié Calmette-Guérin faits à Léopoldville (Congo Belge) en 1926, F. Van den Branden, Rev. Belge d. l. Tuberc., November–December, 1927, xviii, 265.*—(*A. P.*)

Protective Inoculation with BCG.—The service for preparation and distribution of *BCG* vaccine of the Institute of Bacteriology at Liége was opened August 1, 1924.

As soon as Calmette had made known his first encouraging results in antituberculosis immunization of the newborn, Malvoz considered that preparations should be made to answer eventual demands of practitioners desirous of applying it. He obtained permission for the Institute to organize this service. By the end of April, 1927, the vaccine had been administered to 470 children. The numerous previous fruitless attempts at immunization are reviewed, together with Behring's partially successful *Bovovaccine.* Since that time it became obvious that for effective immunity some sort of attenuated, but still living, bacilli would be required. Certain facts had been discovered nearly twenty years ago, namely: *1:* The virulence of the tubercle bacillus, cultivated on a glycerinated medium saturated with pure ox-bile, became progressively attenuated after several successive cultures. *2:* In young calves immunity could be obtained by ingestion of living vaccine-virus, and there were some advantages over administration by other routes. The War unfortunately arrested this work, but later Calmette was able to verify the fact that bacilli on a medium rich in lipoids and alkaline, as bile, acquired hereditary modifications of importance. After thirteen years of uninterrupted cultivation they became innocuous for all species of animals, including anthropoid apes, and did not cause tubercle-formation. Transplanted to the usual culture media they remained avirulent. These bacilli are innocuous for man as well as for experimental animals, and their properties seem to be fixed. Their introduction in proper doses into animals free from preëxisting infection confers a manifest resistance to subsequent virulent infections which invariably are fatal for controls. Such resistance is intimately bound up with the symbiosis between the bacillus-vaccine and certain cellular elements. Giant-cell formation occurs, but there are no true tubercles. It is known that a single slight tuberculous infection may be cured, and that there follows quite a long period during which these animals are refractory to reinfection in considerable doses. In fact, an early slight natural infection would seem desirable provided it is not too closely followed by repeated or massive infections. The frequency of tuberculous infection in children is well known and also the considerable early mortality among children in contact with tuberculous parents. The first attempts at immunization of the newborn began during the latter half of 1922 in the maternity service of *La Charité* hospital. A new series was begun in 1924 among the infants of the VI[e] *arrondissement* of Paris. After eighteen months' observation of 169 children Calmette reported not a single death from tuberculosis. Following this the method spread through all France until, up to January, 1926, 5,183 children had already been vaccinated. Of these, 1,317 could be traced and supervised, among whom the presumable tuberculosis mortality was 0.7 per cent. By January, 1927, 21,200 children had been vaccinated, with a probable tuberculosis mortality of 0.8 per cent among those from one to two years following protection. Those vaccinated more than two years before showed no deaths. *Belgian Results: A: Among 23 Children Vaccinated over Two Years:* There were no deaths from tuberculosis, although the vast majority were brought up in a contaminated environment. There were 2 deaths from other causes (whooping cough, acute bronchitis). *B: Among 115 Children Vaccinated from One to Two Years:* Information was incomplete concerning 62; of the rest, there were 7 deaths, of whom only 2 were brought up in contaminated surroundings, one of these of presumably tuberculous meningitis, the other of enteritis. One of the rest died of "convulsions." *C: Among 34 Children Vaccinated Six Months to a Year:* There was one death from convulsions of a child living with healthy parents. If one calculates the percentage for those children remaining in contact with bacillus-carriers, the mortality from presumably tuberculous affections is 1.8 per cent. Placental transmission of filterable forms of bacilli is invoked to explain these exceptional deaths, or else infection having early before the vaccine exerted its protective effect. The results obtained with the vaccine in Belgium, as in France, warrant its more extensive use.—*La vaccination antituberculeuse par le BCG en Belgique, J. Van Beneden, Rev. Belge d. l. Tuberc., September–October, 1927, xviii, 235.*—*(A. P.)*

Protective Inoculation with BCG.—One of the chief criticisms against Calmette's published results is of a statistical nature. It has been claimed that no nonvaccinated controls are available for a strict comparison with the vaccinated infants. An attempt was made to study two groups of infants under as closely as possible equal conditions, giving both groups the same amount of hygienic care and medical supervision, choosing both from definitely contaminated surroundings only and treating one with *BCG* and leaving the other untreated. On account of these rigid conditions it was necessary to eliminate many children who had been vaccinated and others who had been entered into the control group, so that

at the end only 50 control infants and 20 treated infants were left. All these children were carefully observed for eighteen months. Of the 50 control infants, 9 died of tuberculosis during the observation period. Of the 20 vaccinated infants one died. This study showed further that only those vaccinated children developed allergy who contracted an additional infection. Some of the vaccinated children probably have some pulmonary tuberculosis, but according to the clinical picture it must be of a more benign type than similar processes observed in the nonvaccinated children. It is concluded that the oral administration of *BCG* confers a relative but not absolute immunity against tuberculosis. The fact that vaccinated children may acquire nonfatal tuberculosis must be taken into account in considering revaccination.—*Erfahrungen bei einigen nach Calmette prophylaktisch gegen Tuberkulose behandelten Säuglingen, M. R. H. van den Bergh, Wien. klin. Wchnschr., October 4, 1928, xl, 1400.*—(*M. P.*)

Protective Inoculation with BCG.—Vaccination against tuberculosis by *BCG*, in subjects not previously infected, is certainly harmless. The procedure can be carried out by way of the digestive tract during the first ten days of life, or subcutaneously after that time. By the "alimentary method," the newly-born baby is given three doses of 1 cgm. of *BCG*, according to the indications given by Calmette,—doses which should be repeated at the ages of one and three years. The dose given subcutaneously is from 0.01 to 0.05 mgm. This injection must be preceded by a period of observation, controlled by two negative tuberculin skin-tests at an interval of at least eight days. Vaccinated patients should be kept relatively isolated during the period of immunization, in order to avoid all contamination. Results obtained during the past six years warrant extending the method of vaccination to exposed infants to infants not exposed, but whose parents desire the vaccination; and to adults, especially those who care for the sick and are likely to be exposed to tuberculosis.—*La vaccination antituberculeuse de l'enfant par le BCG, B. Weill-Hallé and R. Turpin, Arch. d. Méd. d. Enf., September, 1928, xxxi, 517.*—(*P. J. W.*)

Protective Inoculation with BCG.—Since July, 1924, preventive vaccination has been applied to a large number of newborn infants, in both France and foreign countries. The preceding experimental work had led to the following conclusions drawn from it: *1:* An animal which ingests at a single meal a small quantity of tubercle bacilli, finely divided, is sure to contract tuberculosis, either pulmonary or lymphatic, or both, reacts to tuberculin for one or two months or more, and may recover. *2:* Animals thus recovered are no longer susceptible, at least for a certain time, of being reinfected, even though they are made to ingest considerable amounts of virulent bacilli. They are, therefore, vaccinated. *3:* Animals submitted to two or more successive reinfections by the digestive route, repeated at short intervals, never recover. Their lesions develop rapidly toward caseation. These facts explain why cattle killed in the abattoirs, and men accidentally killed, so often show at autopsy anatomically cured lesions. It has been experimentally shown that a single mild bacillary contamination determines generally an infection which remains benign and confers a manifest resistance to subsequent reinfections, while several contaminations repeated at short intervals, or if massive, provoke a grave and more or less rapidly fatal tuberculosis. Prophylactic experiments were directed toward obtaining as early as possible an impregnation of the lymphatic system by the microörganism, but with living tubercle bacilli deprived of virulence. It was deemed impracticable to realize the sort of immunity attempted by Webb and Williams in the United States, and, more recently, by Selter in Germany, by the use of extremely minimal doses of normally virulent or weakened bacilli, because the sensitiveness of subjects according to type and race is too variable to overcome the fear of creating a fatal infection. It was then sought to create artificially a strain of tubercle bacilli actually deprived of virulence for all animal species and of hereditarily fixed character. After many vain attempts a medium was found in 5 per cent glycerinated ox-bile, which added to potato, caused a transformation after 30 recultures at 25-day intervals, of an originally virulent bovine bacillus into one harmless to guinea pigs and calves. After 230 such passages over 13 years the bacillus ceased to produce tubercles, but still remained an excellent antigen and an active producer of tuberculin. These bacilli, administered to animals by the digestive route, or subcutaneously or intravenously, conferred on them the power to resist ordinarily virulent reinfecting doses of tubercle bacilli. It was then decided to use these bacilli to create artificially in sensitive individuals, from a very early age, a fortification or protection against accidental contamination. The intestinal route was used because of the ease of passage of tubercle bacilli through its mucosa in early life. In adult subjects such passage may

also occur but is usually much reduced and uncertain. *Tuberculosis Mortality in Infants Under One Year. Intra-Uterine Infection:* Investigation through the antituberculosis organizations and social hygiene dispensaries of 1,364 children born in 1922 of tuberculous mothers, or brought up in a contaminated home, showed that 24 per cent had died within a year of presumably tuberculous affections, and in Paris the figures were 32.6 per cent. Even more formidable figures were gathered at Stockholm by Forssner, and by Bernard, Debré and Lelong (70 to 82 per cent). Many pediatricians also cite figures over 59 per cent and hospital statistics are similar. Strauss collected the records of 6,820 children of 1,410 tuberculous families at the Paris dispensaries from 1906 to 1911. Over 50 per cent were dead, and in the case of 81 families having 763 children, over 75 per cent. Margarete Röpke has recently shown that 40 per cent of positive cutireactors under one year are to be found among those in contact with so called negative-sputum cases, which exemplifies the danger of even closed tuberculosis. It has been noted that often the mesenteric lymph nodes of young children apparently free from tuberculosis and dying of diverse maladies yield virulent tubercle bacilli, although no macrosopic lesions were to be found. It is assumed that these infants were victims of intrauterine infection by a filterable form of the tubercle bacillus capable of reverting to type. *Extension and Results of Preventive Vaccination of Infants in France, July 1, 1924–January 1, 1927:* Moine, statistician of the *Comité National de Défense contre la Tuberculose*, has taken charge of the records of 982 children vaccinated at least a year ago, who have lived in contact with bacilliferous persons and of whom news was available for at least three months. The results for those vaccinated one to two years (882) showed a general mortality of 8.9 per cent and a probable tuberculosis mortality of 0.8 per cent. Those vaccinated over two years showed no deaths. Even if in the tuberculosis mortality are included those dead of causes not specified it would still be under 4 per cent, or one-sixth of the ordinary mortality in exposed infants in France. Biraud, chief of the Statistical Service of the Institute of Hygiene of the Medical Faculty of Paris, in an independent study, found a general mortality for the first year of about 7 per cent and for the second year of 1 to 2 per cent. The tuberculosis mortality was about 2 per cent for the first year, and zero for the second. He studied 1,050 infants in contact with tuberculosis and 487 in contact with tuberculous mothers. As the general infantile mortality in France for the first two years is 8.7 per cent, the vaccinated actually showed no increase in mortality. The actual vaccinations were carried out, in the case of the department of the Seine-Inférieure, by a nurse sent out from the Office of Public Hygiene or the dispensary with the consent of the mother in a family under surveillance. *Probable Duration of Immunity Conferred: Revaccinations:* The protection in the case of cattle lasts fifteen to eighteen months. Yearly revaccinations reinforce the immunity. There is reason to think that the child is protected against virulent reinfections for over four years. *Objections and Criticisms: 1:* Possible return of virulence: Up to the present, no investigator has been able, by successive passage in susceptible animals, to restore to *BCG* its capacity for producing tuberculous lesions. One autopsy was performed on a vaccinated child dying of congenital syphilis at the age of six months. Its mediastinal and mesenteric lymph-nodes showed acid-fast bacilli, but these did not infect guinea pigs. *2:* Lesions produced by intravenous inoculation of laboratory animals: Some of these, killed three to five weeks after such inoculations, showed small follicular lesions of lungs, liver and spleen; these, however, never caseate, but cure spontaneously and disappear without trace in a few weeks. *3:* Relative absence of tuberculin hypersensitiveness: Children protected by *BCG* often fail to react or react only after a considerable time to tuberculin. Some young animals, inoculated subcutaneously or intravenously with small doses, never react, or after a time cease to react. However, it is no longer considered that tuberculin hypersensitiveness parallels immunity or is necessary for it. It is only when the lymphatic system has long been impregnated that it appears. *4:* Failures: Against intrauterine infection vaccination can not avail. Also, massive contaminations may overwhelm the body despite the resistance created. Or, in some cases, they may have already occurred before vaccination has had time to operate. Percautions and education are still necessary.—*Sur la vaccination préventive des enfants nouveaux-nés contre la tuberculose par le BCG, Calmette, Guérin, Nègre and Boquet, Rev. Belge d. l. Tuberc., September–October, 1927, xviii, 221.*—(*A. P.*)

Protective Inoculation with BCG.—Experiments with guinea pigs and rabbits with *BCG* as a whole verified the contention of Calmette as to the harmlessness and immunizing property of this microörganism. Inoculation of the culture led to tuberculous infection in guinea pigs and rabbits, which,

however, ran a favorable course in the majority of cases. Progressive disease in the animals never occurred, but healing of the pathological changes was the usual result. Only when large doses were given intravenously to guinea pigs and rabbits did harmful effects ensue. No increase in virulence of the bacilli could be determined upon further inoculation of the tuberculous organs of the *BCG* animals. Tuberculin hypersensitiveness followed parenteral introduction of the bacilli. A protective action against subsequent infection after previous treatment with *BCG* was determinable, but this was less certain following oral than parenteral treatment.—*Experimentelle Untersuchungen an Meerschweinchen und Kaninchen über die Schutzwirkung der Kultur BCG (Calmette), B. Lange and K. Lydtin, Ztschr. f. Tuberk., 1928, l, 45.—(H. J. C.)*

Protective Inoculation with BCG.—The authors report on experimental studies with *BCG* and describe in detail the technique used. Tuberculin-negative guinea pigs were given intraperitoneal injections of *BCG* in increasing doses, and there resulted, upon microscopic examination, foci containing acid-fast bacilli in the liver, as well as tuberculous changes in the omentum. A study of the weights of the animals indicated that the changes occasioned by the *BCG* used did not necessarily involve the general well-being and body-weight of the animals. For comparison guinea pigs were infected with virulent bovine tubercle bacilli. It was found that the *BCG* strain used could also cause death in the animals. If immunity occurs as the result of treatment with *BCG* this can result only from infection. The immunity experiments are not concluded, but the authors warn against the immunization of infants, and suggest that tests be limited to animal experiments for the time being. The *BCG* strain is not considered avirulent for guinea pigs, but a microörganism of reduced virulence only.—*Versuche mit dem BCG-Stamm Calmettes, H. Chiari, E. Nobel and A. Solé, Ztschr. f. Tuberk., 1928, l, 24.—(H. J. C.)*

Protective Inoculation with BCG.—Baron and Greenwood have claimed that Calmette's statistical results must be wrong because the vaccinated infants showed a decreased total mortality and because the mortality in the second half year of life was greater than in the first half, while in all other mortality statistics by far the larger percentage of children die during the first year of life. It is, however, quite possible that the vaccination raises the resistance not only against tuberculosis, but against other diseases as well. In several thousand calves, which were vaccinated in Italy, it was noticed that the usual diseases of the early age were markedly diminished in frequency. This is particularly true for the so called septicaemia (infectious pneumonia in calves). The mechanism of this increased resistance must be investigated further. For the present it is important to emphasize that a decrease in the total mortality of vaccinated infants is definitely possible and that such a result is supported by observations on vaccinated animals.—*Zur Frage der Impfung der Neugeborenen gegen Tuberkulose mit BCG, A. Ascoli, Wien. klin. Wchnschr., September 30, 1928, xxxviii, 1351.—(M. P.)*

Protective Inoculation with BCG.—The *BCG* strain is tuberculogenic, but not pathogenic. It is to be considered as a *virus fixe* which does not increase its pathogenicity in the animal body. Animals inoculated with *BCG* do not develop the same degree of tuberculin allergy as do animals injected with virulent strains. It is advised that clinics in Austria should use the immunization of newborns as advocated by Calmette.—*Zur Schutzimpfung nach Calmette mit BCG, R. Kraus, Wien. klin. Wchnschr., July 26, 1928, xli, 1082.—(M. P.)*

Protective Inoculation of Infants with BCG.—With reference to a recent article by Calmette in the *Wiener klinische Wochenschift*, it is pointed out that the apparent reduction in mortality in vaccinated children must be due chiefly to the fact that they are under constant medical observation and not to the vaccination.—*Zur Frage der Impfung der Neugeborenen gegen Tuberkulose mit BCG, J. Bâron, Wien. klin. Wchnschr., xxxii, 1167.—(M. P.)*

Protective Inoculation of Animals with BCG.—In numerous experiments on guinea pigs, rabbits, goats and horses, an increase in the pathogenicity of *BCG* has never been observed. Since January, 1927, large numbers of newborn calves in tuberculous herds have been immunized. The general development of these animals was satisfactory. Definite records can be published only after the immunized animals have been slaughtered. A number of monkeys were immunized with 50 mgm. and reinfected with human and bovine bacilli intracutaneously. Normal controls developed the usual primary progressive ulceration, while the immunized animals developed only a small hard infiltration which did not ulcerate nor progress.—*Zur Frage der Schutzimpfung nach Calmette mit BCG, F. Gerlach, Wien.*

klin. Wchnschr., July 26, 1928, xxx, 1083.—(M. P.)

Fixity of BCG.—A guinea pig, infected intraperitoneally with 10 mgm. of *BCG*, died spontaneously seven months later. Small abscesses in the omentum contained acid-fast bacilli, which did not grow on culture media and which did not produce any lesions in other guinea pigs. On the basis of this one observation the conclusion is reached that the *BCG* does not revert to its original pathogenicity after prolonged life in a susceptible animal. The various reports quoted from the literature seem to support this opinion.—*Zur Frage der Veränderlichkeit des BCG—Stammes durch Passage, Fujioka, Wien. klin. Wchnschr., August 23, 1928, xxxiv, 1220.—(M. P.)*

Criticism of Calmette's Statistics of BCG.—In his latest paper Calmette has introduced statistical errors and misrepresented the published work of other writers. Weinberg's very careful statistical study has been misrepresented; it is far from supporting Calmette's statement that about 25 per cent of the children of the tuberculous died of tuberculosis in the first year of life. Other examples are quoted to show the careless and misleading way in which Calmette represents data from the literature. Weinberg's figures were in reasonable agreement with those of Kjer-Petersen and Ostenfeld, Bergman, and Dörner, making the rate of mortality of the order of 5 to 10 per cent rather than of 25 per cent. The mortality rate of 7.7 per cent in Kjer-Petersen and Ostenfeld's series is the rate of mortality from all causes, namely, 19 deaths among 245 children, and of these 19 deaths only 12 were assigned to tuberculosis. One hundred and one of the children had a tuberculous mother or two tuberculous parents, and of these 101 children 4 died of tuberculosis, while the remaining 8 deaths from tuberculosis occurred among the 116 children whose fathers only were tuberculous. The fundamental importance of Kjer-Petersen and Ostenfeld's paper is due to the fact that it is based upon data compiled on statistically sound principles. The 3,808 children in Calmette's report are definitely stated to have been vaccinated less than a year from the date of closing the observations. Therefore, if the record of mortality extended from birth to the first anniversary of birth it covered some part of the first year before they had been vaccinated at all; if it only covered the period during which the infants belonged to the vaccinated class it is not a record of the mortality of the whole of the first year of life, but only a part of that year. Whatever the mortality in the group of 3,808 vaccinated children may be, it cannot be compared with the rate of mortality in the first year of life. Omitting three cases of death after the age of one year, it is found that no less than 38.26 per cent of the total deaths were at the ages of six to twelve months, and only 12.17 per cent in the first month of life. It is well known that the greatest proportion of deaths in the first year occur in the first month of life. Thus, in England and Wales (1926) 45.38 per cent of the total deaths under one year occurred in the first month of life, and only 23.28 per cent at ages over six months. The explanation for this disagreement is presumably the fact that Calmette is not dealing with the mortality from birth, but from a later date on. The total number of registered deaths from all forms of tuberculosis at ages under one year was 826, or 1.8 per cent of the whole number, 48,757, of deaths under one, and 1.24 per 1,000 of the total number of live births, 694,563. Suppose, then, we were to take by lot every tenth registered live birth and to divide the sample of, say, 70,000 live births into two sets of 35,000 each, to treat one moiety and leave the other as a control series. We should expect, on the average, some 43 deaths from tuberculosis in the control series, the expectation being subject to an error of sampling of approximately 6.6. If then, in the treated series there were 23 or fewer deaths from tuberculosis, we should reasonably conclude that it was easier to believe that the treatment had really been beneficial than that a very improbably large divergence had arisen by the luck of sampling. These figures are quoted to show that only experiments on samples of the population, so large as to be virtually impossible, could prove the efficiency of immunization in a statistically convincing manner. It was, therefore, a sound instinct to seek for a decision amongst the class of material in which a higher rate of mortality was to be expected. This is the significance of Kjer-Petersen and Ostenfeld's works. With a total death-rate of from 5 to 10 per cent, samples of 500 would yield significant data. In the control group of 500, from 25 to 50 deaths would be expected, and if the treated sample returned only some 15 to 30 or fewer deaths, a case would have been made out which would be rather strong. Whether such a method could be used, is hard to say. Calmette's latest report "cannot be regarded as a serious contribution to scientific literature at all."—*Professor Calmette's Statistical Study of BCG Vaccination, M. Greenwood, Brit. M. J., May 12, 1928, no. 3514, 793.—(W. I. W.)*

Musculature of Bronchi and Lungs.—A conception of the structures and functions of the system of smooth muscle of the bronchi and lungs is presented in a review of some 492 articles on the subject. The bronchial musculature consists of a network of spiral and circular fibres, whose form is a replica of the entire airway with all its branches and terminals. Thus it may be divided into local regions corresponding to the trunk and all the branches of the tree, but it must be considered as an uninterrupted system, manifesting, like the arterial tree, local calibre variations under the influence of the associated nerves, but comprising one complete anatomical and physiological entity. A proper appreciation of its form is essential to an understanding of its function. In the purely conducting part of the airway it divides and subdivides with the bronchi and bronchioli, and in the terminal bronchioles it embraces relatively the narrowest part of the system. It passes uninterruptedly into the respiratory portion of the airway, the walls of which show openings unilocular or multilocular respiratory chambers. These walls are thus sieve-like, the apertures being embraced by sphincteric rings of muscle mixed with elastic tissue. This branched system of cylindrical sieves, with the respiratory chambers opening therefrom, forms the primary lobule of the lung, whose stem is the "respiratory bronchiole." This is the essential "bellows" of the lung, and in the action of this bellows the muscle plays a part. The bellows could not open up if the muscle did not relax in inspiration. During expiration its contraction has the effect of shortening and narrowing the sieve-like respiratory tubes and their offshoots, and thus of driving out the air. The muscle system is built to shorten and narrow all parts of the bronchial tree, "conducting" as well as "respiratory," in expiration,—in brief, to diminish the dead space. It is thus capable of exerting an important motor rôle in lung deflation in association with the elastic tissue. The evidence from roentgenoscopy, bronchoscopy and other methods of investigation, as well as that from recent and classical anatomical and histological researches, is carefully reviewed. The dead space is interpreted in an anatomical manner as bronchial capacity. It is a variable quantity, enlarging in inspiration and diminishing in expiration, and is controlled in large measure by the bronchial muscle. Rhythmic variations have been described in it, indicating probably that the muscle is constantly manifesting a peristaltoid activity, the direction of the waves being toward the larynx. It is well known that foreign radio-opaque pastes may be shown by X-rays to be eliminated from the bronchi by a peristaltoid movement, which, in emergencies, doubtless functions to remove heavy exudates. The innervation by vagus and sympathetic fibres is discussed, and the theory advanced of an antagonistic action between the motor chest-wall and floor, on the one hand, and the bronchial musculature on the other, the latter relaxing when the former contracts, and *vice versa*. In this way the air-tubes are allowed to dilate during inspiration, facilitating air entry, and are shortened and narrowed during expiration, thus assisting in the removal of used air and in the accommodation of the bronchial tree to the diminishing volume of the lungs. The large number of contributions bearing on the action of drugs on the bronchial muscle is reviewed and the results classified. The broncho-dilatation of adrenalin is looked upon as of protective value in asphyxia. The involvement of the bronchial muscles in asthma is discussed with relation to its various excitants, and the *locale* of the spasm. Anaphylaxis is similarly considered, together with other pathological conditions, such as massive collapse of the lung. The widespread but tenuous "interstitial" muscle is described. The lung is emphatically a muscular organ and must be considered as such clinically.—*The Musculature of the Bronchi and Lungs, C. C. Macklin, Physiolog. Rev., 1929, ix, 1.*—(*C. C. M.*)

Finer Structure of Lung.—A time-honored and traditional conception of the lung is that of a gland in which the pulmonary "alveoli" are lined by "respiratory epithelium." A reinvestigation of these structural details tends to shift this current conception of the lung to that of an organ that is primarily vascular. Most embryologists agree that the *Anlage* of the lung appears as a spherical vesicle connected with the digestive tract; and that the alveoli are derived from the terminal part of the bronchial tree and are lined by epithelial cells. With few exceptions, writers subordinate the capillaries to the glandular construction of the lung, and the capillaries are held to course in the so called "interalveolar septums." Little is mentioned as regards the finer structural details of the septa and the exact position and relation of the capillaries to the respiratory surface. With regard to the phagocytes of the lungs there are essentially two opinions: the first, the older and traditional, that these cells are desquamated and proliferating epithelium; the second and more recent, that they are septal and mesodermal in origin. The most recent study is by Lang (1925), who concludes that these alveolar phagocytes are not epithelial, but

mesodermal in origin, and derivatives of the reticuloendothelial system. Here are included the so called "respiratory cells," "alveolar phagocytes," "dust cells," "heart failure cells," "macrophages," "cuboidal cells" and "septal cells." Lang, therefore, includes the inflammatory phagocytes and those of other pathological processes under the same septal-cell-class derivatives. According to him the endothelial cells of the capillaries do not possess phagocytic qualities, and do not participate in pulmonic reactions,—not even in the formation of the tuberculous "epithelioid cells." Lang further concludes that the alveoli are not lined by any respiratory epithelium. The following questions now naturally present themselves: What is the position of the so called alveolar epithelium in relation to the alveolar septa; what structural elements enter into the formation of these septa; and, finally, just what is the position of the capillaries in these septa and their relation to the alveolar epithelium? The personal observations of the author consisted in the study of stained sections of human foetal lungs in partial series, human adult lungs, and adult cat's and dog's lung. In the foetal specimens it was found that in no stage in the development of the lungs could a characteristic glandular arrangement of alveoli be noted or any evidence that the alveoli are formed as budding growths from the terminal parts of the bronchial tree. A clean-cut distinction between bronchial tree and the rest of the pulmonary tissue was maintained throughout. On the contrary, the bronchi appear to invade the mesodermal mass, the mesodermal cells around the bronchi then form capillaries, and the mesoderm continues to differentiate into capillary loops. Hence the adult lung presents itself as an extensive glomerular capillary network, with remaining mesodermal cells at irregular intervals among the capillaries. These cells are probably identical with the septal or phagocytic cells already referred to. According to the author's observations the lung consists of a bronchial system which is distinct from the capillary parenchyma, the latter appearing as the essential anatomical and functional pulmonary unit. Here, somewhat as in the kidney, a tubular system (bronchi) is attached to a capillary (glomerular) network. The term *alveolus*, if retained, should be used in the sense of *air-space* or *air-sinus*, rather than in the glandular meaning. In the present investigation no non-nucleated plates were seen (thin sections). When thick microscopic sections were studied for the demonstration of these cells, the impression gained was that the "cement" lines seen in silver preparations were largely due to the extensive elastic-tissue framework of the lung. *Summary:* Developmentally, the bronchi invade a layer of mesoderm; hence the lung is of dual origin. Mesodermal cells form the capillary system, and other mesodermal cells persist as septal cells. The septal cells are probably not epithelial cells, but persistent mesodermal cells spread irregularly among the capillaries. These mesodermal cells should be classed as part of the reticuloendothelial system. Evidence was not found that the alveoli develop as an out-growth of the bronchial tree. At no stage in the development of the lung proper could a characteristic glandular arrangement of alveoli be definitely demonstrated. The capillaries form the essential anatomical and functional unit of the lung (glomerulus). Evidence of a definite perivascular lymphatic system was not discovered. Anatomically, the above conception of pulmonary structure invites renewed study of the pathogenesis and histogenesis of the lesions in pneumonia, emphysema and tuberculosis.—*The Finer Structure of the Lung, with Special Reference to Its Vascular Character and Its Pathologic Significance, S. B. Rose, Arch. Path., July, 1928, vi, 36.—(J. S. W.)*

Early Cellular Reaction to Tuberculous, Infection.—In a series of rabbits, infected intravenously with bovine tubercle bacilli, the tissues were studied by the supravital technique before fixation. The lungs revealed a pathological response in twenty-four hours; the specific response in the liver, spleen, lymph nodes and bone-marrow occurred from the 6th to the 14th day. The earliest and most obvious reaction in all organs is the clasmatocytic response, and the development of the tuberculous tissue, epithelioid and giant cells, is always preceded or accompanied by a stimulation of monoblasts and young monocytes, apparently *in situ*. Recent tissue-culture studies by Carrel and Ebeling, and Lewis and Lewis, have lent support to the idea that the phagocytic mononuclear cells constitute a single strain. This conclusion is not accepted by the authors, although they admit that under the conditions of tissue culture the monocyte and the clasmatocyte both respond alike to certain stimuli. Since 1914 the monocyte has been generally recognized as making a third strain of the white cells of the blood, distinct from leucocytes and lymphocytes. The differentiation of lymphocytes and monocytes can be made in a good methylene-blue-azure stain. The cytoplasm of the monocyte reacts with a dense muddy blue color, in which are embedded, in the human strain, varying numbers of tiny azurophilic granules, which are not

identical with the azure granules of lymphocytes, since they are smaller and stain darker. The clearness with which these tiny granules may be seen is a good gauge of the success of the stain and the adequacy of the lens used. These granules can be seen with dark-field illumination in the living cell. This granulation in the human monocyte is neither the same substance as the bodies that react to neutral-red in the living cell nor the mitochondria. In the monocyte of the rabbit there is a marked reduction of the azurophilic bodies in fixed films, most of the cells showing none at all, and the granulation visible in dark-field illumination suffers a corresponding reduction. The peroxydase reaction has been found to parallel the azurophilic granulation of the monocyte qualitatively and quantitatively, most human monocytes giving a positive oxidase reaction, the opposite being true of the rabbit monocyte. The supravital technique affords an adequate and assured method of discriminating between lymphocytes and monocytes. The lymphocyte is characterized by a clear cytoplasm, in which are many mitochondria (green) and a few scattered vacuoles (red) when stained with neutral-red and Janus-green by this technique. The nucleus is seldom round, but changes constantly in shape as the cell moves, and the nucleus is always in the front end of the moving cells and seems to take an active part in the locomotion of the cell. The monocyte, on the other hand (human and rabbit), shows a rosette of neutral-red bodies of a uniform salmon tint and a great number of tiny mitochondria. The vacuoles stain with neutral-red as in the lymphocytes. In the specific reaction to tubercle infection, the epithelioid and giant cells of rabbit and human tissues are indistinguishable in their characteristic reaction to vital dyes, while obeying the species response to the peroxydase reaction, that is, rabbit epithelioid, oxidase negative; human epithelioid, oxidase positive. Monocytes in motion are stretched out often in triangular shape; there is a slow progression, with less active streaming of particles than with the polynuclear leucocytes. The monocyte is still regarded by some as identical with the clasmatocyte of the connective tissues. There are certain criteria, however, which will help to differentiate these phagocytic mononuclear cells. The cytoplasm of the clasmatocyte stained in methylene-blue appears as a faintly basophilic thin film in contrast to the dense blue cytoplasm of the monocytic strain. The cytoplasm of the clasmatocyte, also, has no specific granulation except for substances phagocytized. Hence, when granules are present, they may be of any size from tiny points to whole included cells, and they may react to dyes according to the original nature or condition of the substance taken in. Likewise, in the supravital technique, the clasmatocytes vary all the way from a small cell with a few vacuoles stained with the neutral-red up to enormous cells engorged with whole cells and debris. In general, there are two groups of clasmatocytes; first, the constantly active phagocytes of certain organs, the derivatives of the so called specific-endothelia, namely, of spleen, lymph nodes, bone-marrow and liver; and second, the normal, less active phagocytes of the general connective tissues. With the supravital technique the normal monocyte of the blood and the resting clasmatocyte of the tissue are readily discriminated by the nature of the stained vacuoles. In the reaction to neutral-red, the monocyte shares an almost uniform color of the vacuoles in a given cell, and the shade is of a salmon tint, which may become a carmine tone in the tiny vacuoles of the epithelioid cell. The color of the vacuoles of the clasmatocyte varies all the way from red to yellow in one cell, and there is every possible combination of shades with marked changing toward yellow in many cells if the dilution of the neutral-red is carefully adjusted. It is clear that while there is an overlap in color reaction of these two strains toward the acid range (red) of the dye, only the clasmatocyte tends towards an ultimate alkaline (yellow) reaction. In studying living cells taken directly from the animal, a rosette formation is the exception for the clasmatocyte and the rule for the monocyte. Moreover, in the epithelioid (monocyte) cell of the tuberculous process, the rosette formation of the neutral-red bodies become the constant chief morphological characteristic of the cell. The occurrence of acid-fast granules in tuberculous tissue is well known to the pathologist, though it is not regarded as sufficient evidence for the diagnosis of the disease in the absence of, or the failure to find, the intact bacilli. Observations made on the infected rabbits indicate that there is a certain difference in the response of two closely allied strains of mononuclear cells to this specific pathological agent; that while both clasmatocytes and monocytes are, under appropriate conditions, highly phagocytic types, the one form tends to break up tubercle bacilli and the other type retains them intact and alive with reproductive multiplication for long periods of time. In the colored plate accompanying the article are figures of cells from a scraping from the lung of a rabbit four days after the injection of tubercle bacilli. An epithe-

lioid cell (monocyte), a giant cell and a clasmatocyte are shown. The young epithelioid cell is seen to contain seven intact tubercle bacilli. The cytoplasm stains a deep blue in contrast to the pale, foamy, and much vacuolated cytoplasm of the clasmatocyte. The giant cell is filled with great numbers of intact tubercle bacilli, and its cytoplasm stains a deep blue exactly like the monocyte. In the clasmatocyte, on the other hand, instead of intact bacilli are seen only acid-fast fragments. In these studies it appears that the immediate major response of the connective tissues to tuberculous infection involves two strains of cells, clasmatocytes and monocytes. The clasmatocytes are the macrophages of the general connective tissues, and respond by phagocytizing and destroying tubercle bacilli, in which process many of the clasmatocytes themselves are destroyed. During tuberculous infection great numbers of clasmatocytes containing acid-fast debris may be found in the tissues. With the monocyte, on the other hand, the infection exerts an influence through which this cell becomes the typical epithelioid type, eventually making the characteristic lesion of the disease; in the epithelioid and giant cells the tubercle bacilli remain intact and apparently survive over long periods of time. The epithelioid cell appears in the lung within twenty-four hours after the injection of the bacilli, which is correlated perhaps with the observation that in the lung normally at all times are numbers of mature monocytes. In other organs, the normal presence of monocytes is limited, and may represent one of the facts in organic susceptibility; the normal number of monocytes or the degree to which monoblasts may be stimulated to development and maturation, together with the activity of the clasmatocytes in destroying bacilli, in any particular region, would appear to be a function of the rapidity and extent of the local tuberculous involvement.—*The Reaction of Monocytes and Clasmatocytes to Early Infection in Rabbits with Bovine Tubercle Bacilli, F. R. Sabin and C. A. Doan, J. Exper. Med., October 1, 1927, xlvi, 627.*—(*J. S. W.*)

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